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Analysis of Perception and Actual of IT Competency

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Abstract

In recent years, interest in Computational Thinking (CT) has been increasing in many countries. It is highly expected that CT will increase as an increasing number of people learn IT (ICT) and computer science. Accordingly, this study analyzed the difference in TOPCIT scores by gender and the gap between expected and actual competency levels. Consequently, females showed a high level of achievement in 'Technical Communication', and males showed a higher level of achievement in 'Software'. It was also revealed that there is a big gap between the expected competencies of both male and female students and their actual competencies. This study suggested that TOPCIT is contributing to analyzing the gap between actual IT competency and perceived IT competency and correctly understanding their competency.

Keywords: Computational Thinking, IT Competency, TOPCIT

1. Introduction

As we are advancing into the digital age due to the advances in IT (including ICT), in the knowledge-based society, people who constantly utilize knowledge to create new knowledge and are capable of creative and self-directive learning[1] Today, many countries recognize the importance that education and training in Information technology (IT) has for providing citizens with the necessary skills to access information and participate in transactions through these technologies[2]. Recently there was a change in the educational paradigm, and changes are occurring in order to effectively teach the core competencies of the 21st century, such as information and communication technology and information literacy[3,4]. In other words, not only middle and high school students, but also college students must break from the traditional knowledge-centered paradigm and develop the competencies required by the modern society. That is, efforts not only to use digital information to communicate more logically, but also use computers in their own fields to maximize their expertise are required[5].

Interest in IT concerns the enhancement of the Computational Thinking (CT) of K-12 students. That is, many studies have suggested that the CT of students will be enhanced if IT education is provided. Accordingly, interest in SW, IT and Computer Science education has risen and various kinds of education to enhance computational thinking at the national level have been proposed[6,7]. Soon afterward studies to measure computational thinking followed[8-10].

In recent years, popular interest has gone beyond raising the educational effect of IT utilization. Good use of IT now means the educational system can use information more flexibly[11]. As students using a lot of information can have diverse experiences, efficient utilization of IT can contribute to improving their problem-solving capabilities in everyday life[12]. Accordingly, schools must enable

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students to enhance their problem-solving capabilities by developing their IT-related competencies[11]. In other words, in the information society where information and communications technology continuously changes, education must be able to develop students' IT (ICT) literacy[13,14].

Knowledge management in an educational context can be defined as follows: "the systematic process of finding, selecting, organizing, distilling and presenting information in a way that improves a learner's comprehension and/or ability to fulfill his or her current learning objectives[15]".

The US announced the 'Next Generation Science Standards' (here in after referred to as NGSS), based on two decades of researches, in 2013[16]. NGSS classified engineering practices into 8 methods, and proposed computational thinking among them. That is, computational thinking analyzes vast amounts of data, models the dynamism of complex systems and reveals its value from the viewpoint of solving problems in the surroundings including various elements[17]. Thus, improving CT through IT education is an obligation of universities. In the USA, such are the competencies that talented persons of the future are expected to have[18,19].

To improve computational thinking, Korea is reinforcing software education, and colleges are improving IT education. In other words, these initiatives are part of the efforts to address manpower shortages required by enterprises by improving the quality of college IT education, and build the infrastructure for the growth of new industries. Furthermore, the need to induce the qualitative improvement of IT departments and college graduates who account for the biggest portion of the IT professionals was taken into consideration.

If education prior to 2013 considered the ability to utilize IT, diverse efforts to foster software manpower are attempted from 2014. Efforts to foster software manpower began in 2011, and the 'University IT education improvement plan' was proposed in April[20]. The government's effort to reinforce IT manpower gave birth to TOPCIT (Test Of Practical, Competency of IT), which tests the IT competency of not only college students, but also IT workers. The national competency test can be said to test the competency they perceive. In other words, those who graduated from IT-related departments or work in the IT field will perceive that they have the knowledge required in their fields to a certain degree[21]. Accordingly, if the level of perceived knowledge and the level of their actual knowledge are tested, it will be easy to see in which areas they need to make more efforts.

Therefore, the purpose of this study is to analyze the IT competency perceived by TOPCIT participants and the actual IT competency measured in the test.

2. Method

To measure IT competency, this study compared the level of IT competency perceived by the participants and their actual IT competency.

Table 1. Subjects

	Frequency	%
male	1243	75.2
female	411	24.8
total	**1654**	**100.0**

As can be seen, more males (75.2%) than females (24.8%) participated in this study.

The subjects of this study were college juniors and seniors, and office workers who graduated from IT-related departments within the previous three years. The gender distribution of the subjects is shown in the following table.

2.1 Instrument

IT competency is divided into the 'Technical Area' and the 'Business Area.' The technical area is subdivided into software, database, and network/security. The 'business area' evaluates the competencies a project manager must have in addition to IT business. The operational definition of each competency is described below[21] (see Table 2).

If the 'Technical Area' is a competency focused on IT, the 'Business Area' includes more of the business aspect that occurs in the process of using the ICT infrastructure to provide service.

2.2 Criteria

This study used ideal criteria instead of a national test when establishing the criteria. In other words, as it has the same characteristics of a national test, this study focused on the level of IT competency of the subjects rather than relying on test items. Accordingly, criteria were established to show the level of IT competency required when various types of questions are posed. For this study

the bookmark method was used because is considered one of the most appropriate.

When the Bookmark method is used, criteria makers express their judgments by entering markers in an Ordered Item Booklet (OIB) consisting of items ordered from easiest to most difficult[22].

According to the Bookmark method, the criteria used for this study were set in the following procedure:

Stage 1: An 'OIB' consisting of test items ordered from easiest to most difficult was distributed to every panelist.

Stage 2: The panelists were divided into 4 small groups of 3 panelists each. Each small group discussed the knowledge and skills students would need to answer each item correctly.

Stage 3: When each small group completed the discussion, each panelist of the small groups was instructed to place a bookmark at the last item that a minimally qualified candidate would have a defined probability of answering correctly. The scale score associated with the item where a panelist placed a bookmark was taken as the panelist's first expected cut-off score.

Stage 4: Panelists discussed their bookmark placements within their small groups. This discussion contributes to reducing the gap in the ratings of the cut-off scores among the small groups and helps them reach a more accurate consensus on the scores. After this discussion, panelists were again instructed to place bookmarks on the OIB items. The scores associated with the items where each panelist placed a bookmark was taken as their second expected cut-off score.

Stage 5: Panelists were divided into medium groups of six. They then held a discussion to exchange their opinions on the cut-off scores the result being that some of the cut-off scores could be changed. After the discussion, panelists again placed bookmarks for each OIB item.

Stage 6: Finally, all panelists met together and discussed the rating scores of the items on which panelists placed their bookmarks. In this discussion, panelists completed exchanging their opinions and finally selected their expected cut-off scores.

Stage 7: The levels were set in this procedure, and the final cut-off scores were set as the criteria.

This Table 3 shows the ideal levels presented by the method of setting the criteria.

Table 2. Definitions of Basic Model Areas of TOPCIT

Area	Definition
Technical Area	Basic knowledge and technical area of ICT elements and systems required for analysis and resolution of problems faced by engineers
Software	Ability to understand the concept and structure of software and system architecture and utilize such understanding in operating, managing, developing, and maintaining on/off-line solutions required for actual business operations
Database	Ability to understand the concept and structure of databases and utilize such understanding in analyzing, designing, operating, and managing databases, and developing and maintaining related application programs
Network & Security	Ability to understand the concept and structure of networks, and concepts and methods of security, and utilize such understanding in operating, managing, developing and maintaining related application programs
Business Area	Area of competency for understanding business requirements, utilizing ICT infrastructure and services to plan, execute and manage efficient delivery methods, and thereby create values
IT Business	Ability to understand the needs for and environment of IT sector management, and business and knowledge required for utilizing business models and solutions to perform given tasks efficiently
Technical Communication	Ability to analyze problems in the IT sector, and communicate and persuade stakeholders with speech, text and media concerning decision-making process and results
Project Management	Ability to efficiently manage and implement the scope, schedule, resources, risks and quality of projects delivered in a series of cycles
Integrated Area	Ability to utilize various skill sets comprehensively to solve practical problems

Table 3. Definition of Levels

Level	Definition
Novice type (Need to Learn, Poor) : 0~99	Poor understanding of knowledge and skill set related to technical and business areas
Knowledge type (Understands, Comprehends) : 100~399	Understands the knowledge and skill sets related to technical and business areas
Challenge type (Demonstrated Problem Solving Skills, Applied Skills) :400~699	Able to solve problems by applying knowledge and skill sets related to technical and business areas
Problem-solving type (Proficient Problem Solving Skills, Adoptive) : 700~899	Able to solve problems by adopting knowledge and skill sets related to technical and business areas
Creative convergence type (Creative Problem Solving, Leading) : 900 or over	Able to take initiative in solving problems by adapting knowledge and skill sets related to technical and business areas

This study also set three standard scores in order to create five levels: Need to Learn (level 1), Understanding, Demonstrated Problem Solving, Proficient Problem Solving, Creative Problem Solving (level 5). This study first queried the IT competency level of each individual through a self-assessment questionnaire before attempting to measure actual competency. The subjects' responses to the questions are shown in the following table.

Table 4. Expected Level Unit: Freq.(%)

Expected Level	Male	Female
1.00	434(36.0)	178(44.3)
2.00	363(30.1)	111(27.6)
3.00	309(25.6)	088(21.9)
4.00	075(06.2)	015(03.7)
5.00	025(02.1)	010(02.5)
total	**1206(100.0)**	**402(100.0)**

The subjects of this study assessed their own levels as being quite low. As for males, 36% assessed themselves to be at Level 1, 30.1% at Level 2, and 25.6% at Level 3. Only 8.3% assessed themselves to be at Levels 4 and 5. Females assessed themselves to be even lower with 44.3% expecting themselves to be at Level 1.

3. Results

The results of this study were divided into two areas. First, they were divided according to gender and then, second, according to the expected (self-assessed) levels with the actual TOPCIT scores.

3.1 TOPCIT Analysis by Gender

Table 5 shows TOPCIT scores by gender.

Table 5. Analysis of scores by gender

	Male	Female	t
	M (SD)	M (SD)	t
Total	189.64 (83.53)	187.92 (71.94)	0.374
Software	070.32(27.50)	066.76 (24.74)	2.327*
Database	012.75 (12.18)	013.81 (12.29)	1.528
Network & Security	014.81(15.52)	009.38(10.97)	6.572***
IT Business	019.54(12.96)	019.18(11.63)	0.509
Technical Communication	017.19(12.17)	018.64(12.10)	2.104*
Project Management	021.65(16.04)	024.48(15.96)	3.102**
Convergence	033.37(33.88)	035.66(32.18)	1.203

* P< .05, ** P< .01, *** P< .001

Looking at the total TOPCIT score by gender shows that the overall score of males was 189.64, while that of females was 187.92. Males had a higher average, but there is no statistically significant difference between the two groups. A detailed analysis of the results reveals that for 'Software' males achieved a higher combined score of 70.32, while females achieved 66.76. This difference is statistically significant at the significance level of .05. Males also scored higher than females for 'Network and Security' with a combined score of 14.81 compared with 9.38 for females. The difference is statistically significant at the significance level of .001.

However, when it comes to 'Technical Communication,' females achieved a combined score of 18.64, which is higher than the 17.19 combined score of males. The difference is statistically significant. Females also achieved a higher combined score than males for 'Project Management.' Females collectively scored 24.48 compared to males who scored 21.65. This difference is

statistically significant. For 'Database' and 'Convergence,' females also scored higher, but there is no statistically significant difference.

It is clear that the above results are different than other studies which show that males generally have a higher level of IT competency.

3.2 Analysis of TOPCIT Achievement According to Expected Levels by Gender

In case of male students, the following table shows the difference between the self-assessed expected TOPCIT level and actual achievement.

Table 6. Analysis of achievement based on the self-assessment of male students

Male students	Self-Assessed Expected Score	Statistic		F (Scheffe')
남학생	Predication	M	SD	F(scheffe)
total	1.00	151.06	67.33	57.156*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)(4,5)
total	2.00	190.19	74.65	57.156*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)(4,5)
total	3.00	216.25	85.01	57.156*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)(4,5)
total	4.00	253.63	84.41	57.156*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)(4,5)
total	5.00	271.84	112.00	57.156*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)(4,5)
total	total	188.42	83.36	57.156*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)(4,5)
Software	1.00	63.69	26.28	12.117*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)
Software	2.00	71.45	25.59	12.117*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)
Software	3.00	76.38	29.22	12.117*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)
Software	4.00	76.95	28.85	12.117*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)
Software	5.00	78.04	31.32	12.117*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)
Database	1.00	8.95	9.85	26.216*** (1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)
Database	2.00	12.57	11.26	26.216*** (1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)
Database	3.00	15.55	13.28	26.216*** (1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)
Database	4.00	19.23	14.01	26.216*** (1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)
Database	5.00	22.76	17.61	26.216*** (1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)
Network & Security	1.00	10.17	11.81	19.356*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)(4,5)
Network & Security	2.00	15.41	15.54	19.356*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)(4,5)
Network & Security	3.00	17.90	16.06	19.356*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)(4,5)

Network & Security	4.00	21.15	19.53	19.356*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)(4,5)
Network & Security	5.00	23.08	20.50	19.356*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)(4,5)
IT Business	1.00	15.04	10.86	29.959*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)
IT Business	2.00	19.71	12.49	29.959*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)
IT Business	3.00	21.86	13.07	29.959*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)
IT Business	4.00	27.31	13.46	29.959*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)
IT Business	5.00	30.56	15.86	29.959*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)
Technical Communication	1.00	14.26	11.37	13.435*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)
Technical Communication	2.00	17.28	11.52	13.435*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)
Technical Communication	3.00	19.06	12.40	13.435*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)
Technical Communication	4.00	22.76	13.78	13.435*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)
Technical Communication	5.00	21.48	13.23	13.435*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)
Project Management	1.00	17.02	14.40	22.189*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)
Project Management	2.00	21.31	15.64	22.189*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)
Project Management	3.00	24.22	16.07	22.189*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)
Project Management	4.00	30.72	17.29	22.189*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)
Project Management	5.00	34.04	18.23	22.189*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)
Convergence	1.00	21.93	25.84	32.062*** (1,2)(1,3)(1,4)(1,5)(2,3) (2,4)(2,5)(3,4)(3,5)(4,5)
Convergence	2.00	32.45	34.18	32.062*** (1,2)(1,3)(1,4)(1,5)(2,3) (2,4)(2,5)(3,4)(3,5)(4,5)
Convergence	3.00	41.28	35.51	32.062*** (1,2)(1,3)(1,4)(1,5)(2,3) (2,4)(2,5)(3,4)(3,5)(4,5)
Convergence	4.00	55.52	38.58	32.062*** (1,2)(1,3)(1,4)(1,5)(2,3) (2,4)(2,5)(3,4)(3,5)(4,5)
Convergence	5.00	61.88	40.02	32.062*** (1,2)(1,3)(1,4)(1,5)(2,3) (2,4)(2,5)(3,4)(3,5)(4,5)

* P< .05, ** P< .01, *** P< .001

As for male students, the higher the self-assessed level, the higher the achievement. Overall, the achievement of students who assessed themselves to be at Level 1 was 151.06, while that of students who self-assessed Level 2 was 190.19, that of students who self-assessed Level 3 was 216.25, that of students who self-assessed Level 4 was 253.63, and that of students who self-assessed Level 5 was 271.84. The higher the expected level, the higher the achievement, however, in case of Level 4, which is the 'problem-solving type,' considering that the overall achievement must be 700-899, the current level of students can be said to be very low. In particular, considering that Level 5 (the highest) requires a score exceeding 900 points, the actual score of students who expected Level 5 was only 271.84, a difference of more than 600 points. That is, the actual level is much lower than the competency that the students expected. In case of male students, students who expected a high level in each area of competency showed a slightly higher level of achievement.

Table 7 shows the achievement of female students according to their self-assessed expected levels.

In case of female students, the higher the expected level, the higher the achievement. Upon analyzing the overall TOPCIT scores, the achievement of students who self-assessed Level 1 was 167.26, that of students who self-assessed Level 2 was 194.34, that of students who self-assessed Level 3 was 213.36, that of students who self-assessed Level 4 was 223.20, and that of students who self-assessed Level 5 was 225.00. What is distinct here is that as the expected level increases, the achievement of female students becomes more similar to that of the male students.

And as for IT Business, the score of the group who self-assessed themselves to be at Level 5 was lower than that of the groups who self-assessed themselves to be at Levels 2,3 or 4. However, there is no statistically significant difference between those groups. As for Technical Communication, as the expected level increases, the achievement was higher, but there is not a statistically significant difference between the groups. When it comes to Convergence, the score of the group who expected Level 5 was similar to that of the group who expected Level 1. In other words,

Table 7. Comparison of expected level of female students according to self-assessment and actual achievement

Female student	**Self-Assessed Expected Score**	**Statistic**		**F (Scheffe')**
여학생	**Predication**	**M**	**SD**	**F (scheffe)**
total	1.00	167.26	68.75	8.255*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)
total	2.00	194.34	70.81	8.255*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)
total	3.00	213.36	66.04	8.255*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)
total	4.00	223.20	86.72	8.255*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)
total	5.00	225.00	42.43	8.255*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)
total	total	187.74	71.92	8.255*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,4)(3,5)
Software	1.00	062.16	23.84	3.619** (1,2)(1,3)(1,4)(1,5) (2,5)(3,5)(4,5)
Software	2.00	070.72	24.54	3.619** (1,2)(1,3)(1,4)(1,5) (2,5)(3,5)(4,5)
Software	3.00	070.58	24.35	3.619** (1,2)(1,3)(1,4)(1,5) (2,5)(3,5)(4,5)
Software	4.00	070.20	33.70	3.619 ** (1,2)(1,3)(1,4)(1,5) (2,5)(3,5)(4,5)
Software	5.00	095.50	3.54	3.619** (1,2)(1,3)(1,4)(1,5) (2,5)(3,5)(4,5)

Database	1.00	010.80	10.88	5.866*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,5)
Database	2.00	014.99	11.94	5.866*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,5)
Database	3.00	16.89	12.94	5.866*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,5)
Database	4.00	20.27	18.29	5.866*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,5)
Database	5.00	23.00	25.46	5.866*** (1,2)(1,3)(1,4)(1,5)(2,4) (2,5)(3,5)
Network and Security	1.00	07.34	9.03	3.965** (1,5)(2,5)(3,5)(4,5)
Network & Security	2.00	09.97	11.11	3.965** (1,5)(2,5)(3,5)(4,5)
Network & Security	3.00	11.66	12.71	3.965** (1,5)(2,5)(3,5)(4,5)
Network & Security	4.00	10.87	8.23	3.965** (1,5)(2,5)(3,5)(4,5)
Network & Security	5.00	25.50	27.58	3.965** (1,5)(2,5)(3,5)(4,5)
IT Business	1.00	17.57	12.08	1.675
IT Business	2.00	19.99	11.57	1.675
IT Business	3.00	19.84	10.46	1.675
IT Business	4.00	23.80	10.65	1.675
IT Business	5.00	19.50	4.95	1.675
Technical Communication	1.00	17.22	12.21	1.247
Technical Communication	2.00	19.79	12.49	1.247
Technical Communication	3.00	19.99	11.43	1.247
Technical Communication	4.00	20.40	12.48	1.247
Technical Communication	5.00	21.50	16.26	1.247
Project Management	1.00	22.15	15.46	3.571** (1,3)(1,4)(1,5)(2,3)(2,5)
Project Management	2.00	23.50	16.11	3.571** (1,3)(1,4)(1,5)(2,3)(2,5)
Project Management	3.00	29.40	15.76	3.571** (1,3)(1,4)(1,5)(2,3)(2,5)
Project Management	4.00	28.67	14.82	3.571** (1,3)(1,4)(1,5)(2,3)(2,5)
Project Management	5.00	30.00	21.21	3.571** (1,3)(1,4)(1,5)(2,3)(2,5)
Convergence	1.00	30.02	31.20	4.323** (1,2)(1,3)(1,4)(2,3) (2,4)(3,5)(4,5)
Convergence	2.00	35.36	31.90	4.323** (1,2)(1,3)(1,4)(2,3) (2,4)(3,5)(4,5)
Convergence	3.00	45.01	32.07	4.323** (1,2)(1,3)(1,4)(2,3) (2,4)(3,5)(4,5)
Convergence	4.00	49.00	34.03	4.323** (1,2)(1,3)(1,4)(2,3) (2,4)(3,5)(4,5)
Convergence	5.00	30.01	14.14	4.323** (1,2)(1,3)(1,4)(2,3) (2,4)(3,5)(4,5)

* P< .05, ** P< .01, *** P< .001

there is a difference between the expected levels and the actual TOPCIT scores.

4. Conclusion

This study analyzed the competency of students based on the results of the TOPCIT that evaluates the IT competency of college students. The analysis was two-pronged: first, there was an analysis of the difference in competency by gender and, second, an analysis to determine whether there is any difference in actual TOPCIT scores by gender according to a self-assessed expected level.

According to the analysis, first, there was no tangible difference by gender in terms of overall TOPCIT competency. A detailed review does reveal that males demonstrated a higher level of achievement in 'Software' and 'Network and Security' to a statistically significant degree, but females, however, show a higher level of achievement in 'Technical Communication' and 'Project Management' to a statistically significant degree.

Second, according to the analysis of the difference in achievement according to self-assessed expected levels by gender, both male and female students showed a higher level of achievement as their expected levels increased. However, it was discovered that their achievement levels were lower than the criteria that experts expected. What is distinct here is that females showed a low level of achievement in IT Business and Convergence although they expected a high level.

Based on the findings, it can be known that there is a big gap between the competency that students self-assess and actual competency. In particular, students tended to overestimate themselves. With regard to their overestimation of their competency, improvements not only in IT learning, but also in the industry are needed. It seems necessary to continuously use the TOPCIT for correctly estimating their competency.

This study is significant in that the actual competency of students in IT-related departments can be significantly different than their self-perceived competency. In particular, it is expected that the diverse findings of this study can be utilized in many countries that must develop and advance IT competency.

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