METACOGNITIVE KNOWLEDGE, SKILLS AND ATTITUDE OF SCIENCE TECHNOLOGY AND SOCIETY STUDENTS ACROSS PROGRAMS

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ABSTRACT

Metacognition can be applied in several disciplines in various ways. There are more subtle ways to include metacognition into the fabric of any course and make it part of both the teacher and students' everyday language. In today's educational environment, metacognition is a powerful construct, and its systematic teaching may promote a sense of independence and autonomy among college students. This study explores and analyzes the metacognition of first-year students enrolled in Science Technology and Society (STS) course during the first semester of school year 2018-2019 at Colegio de San Juan de Letran Manila. The result of the study will be used as basis for the development of syllabus and other instructional and learning materials in STS. Specifically, it sought to: 1. find out the metacognition (knowledge, skills, and attitudes) of freshmen students enrolled in the course (STS) at Letran Manila; 2. identify whether metacognition display significant differences in terms of various variables; and 3. draw out implications in the teaching and learning process in the course (STS). Most of the respondents were communication students (26.5%) followed by psychology students (24.5%), business management students (16%), accountancy students (14.5%), (13.5%) broadcasting students (13.5%), and education and engineering students (2.5%). The participants were 139 (69.5%) female and 61 (30.5%) were male. More than half of the respondents were female (69.5%). The male respondents with a mean of 4.36 reported a slightly higher metacognition than female. The study also showed significant difference among the scores of (STS) student's metacognition according to course or programs. Metacognition was rated the highest among communication students (4.46) and lowest among management students (4.16). The overall mean metacognition (4.35) and the standard deviation (0.439) correspond that first-year students have metacognition. Furthermore, first-year students agree that they have metacognitive knowledge of (4.20), metacognitive skills of (4.07) and metacognitive attitudes of (4.03) in the course STS regardless of their programs. Professors are confronted with classes full of students that have varying levels of metacognitive skills.

INTRODUCTION

In today's educational environment, metacognition is a powerful construct, and its systematic teaching may promote a sense of independence and autonomy among college students. Self-directed learning has been listed as one of the life and career skills needed to equip students for 21st century skills (Van Laar, E., Van Deursen, A. J. A. M., Van Dijk, J. A. G. M., De Haan, J., 2017). College students who succeed academically rely on being able to think effectively, efficiently, and independently. These students do not need to depend on their professors as much as other students who are heavily dependent on guidance and monitoring to initiate and finish a learning task or activity. Self-regulated students are thought to believe that hard work pays off, which motivates them to put in the effort and persevere in academic

activities. (Ames 1992; Weiner 1986; Wolters 2003; Zimmerman and Martinez-Pons 1990). These are the kind of students who consistently monitor their own progress academically. Students define learning standards or objectives, track their progress toward these goals, and then adjust and regulate their cognition, motivation, and behavior to achieve these goals (Pintrich, 2000).

Metacognitive skills can help students enhance their own academic school experiences. It can help students solve problems creatively, think critically, communicate effectively, and collaborate with their peers. It is an awareness of oneself, one's own cognitive skills, strategies, and attitude under different situations because they can easily solve problems creatively as they plan, monitor, assess and finally evaluate and make the needed changes. (Flavell, 1979). Metacognition has a variety of definitions and applications in

various domains. Flavell coined the phrase "thinking about thinking" to describe a cognitive process (Flavell, 1979). Metacognition affects the academic achievement of students, metacognitive knowledge, skills, and attitudes are directly proportional to academic achievement. Students learn more and have longer attention span as compared to their peers with weak metacognitive skill. Metacognition can be compared to being reflective, conscious, and aware of own progress. (Woolfolk, 1998, Young, Fry 2008, Coutinho, Neuman 2008). Metacognition is a complex phenomenon (Boekaerts, Cascallar, 2006; Kane, Lear, and Dube, 2014). John Flavell an American developmental psychologist coined the term metacognition because of his research in 1970's on children's knowledge and control of their memory processes.

Metacognition plays an important factor that can affect the problem-solving behaviors of students especially with outcomes-based education (OBE) that higher education is implementing. It can help students to become independent learners (Swanson, 1990; Artzt and Armour-Thomas, 1992; Fitzpatrick, 1994; Kuiper, 2002). Effective use of basic cognitive processes is a fundamental part of learning especially with the full implementation of Outcomes Based Education (OBE) in higher education. All learners are metacognitive, according to Gunstone (1994), and the pedagogical goal should be to improve metacognition. Students who use metacognitive strategies and metacognitive practices are likely to be able to achieve more as these strategies help students monitor their own progress, take charge of their learning as they analyze, read, write, and solve cases in the classroom. Metacognition is an important factor for an effective and efficient learning. It provides students with the cognitive processes and cognitive strategies to solve a problem or complete a task. (Schraw and Graham, 1997).

The College of Liberal Arts and Sciences (CLAS), of the Colegio de San Juan de Letran Intramuros, Manila, offers Science Technology and Society (STS) a new course under General Education foundation that complements students' professional degrees. Strengthened by the formation process, which combines development of reason, the deepening of faith, appreciation of the living Christian values, CLAS takes pride in answering the needs of today's youth in their search for well-rounded education. Courses in business and professional areas are designed to equip students the skills and experience to enable them to cope with the challenges of the competitive world after they graduate from college.
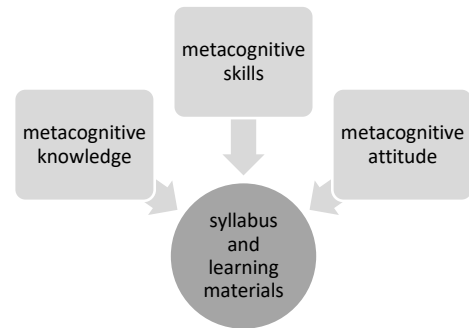
Conceptual Framework

Figure. 1. Conceptual Framework of the Study

The study assessed the students' metacognitive knowledge skills and attitude. The students came from College of Liberal Arts and Sciences, College of Business and Administration, College of Education and College of Engineering and Information Technology and were enrolled in the course (STS) during first and second semester of SY 2018-2019. The Awareness of Independent Learning Inventory (AILI) contains self-survey questions to measure the awareness of independent learning. The survey consists of 45 statements about metacognitive knowledge, skills, and attitudes in learning. The self-assessment questionnaire would reflect the kind of strategies students use to monitor and access their own learning. The result will be used as basis for designing syllabus and other learning materials in the course (STS).

Statement of the Problem

This study analyzes the metacognition of first-year students enrolled in Science Technology and Society (STS) course during the first semester of school year 2018-2019 at Colegio De San Juan De Letran Manila. The result of the study will be used as basis for the development of syllabus development and other instructional and learning materials in STS.

Specifically, it sought to: 1. find out the metacognition (knowledge, skills, and attitudes) of first-year students enrolled in the course (STS); 2. identify whether metacognition display significant differences in terms of various variables; and 3. draw out implications in the teaching and learning process in the course (STS).

MATERIALS AND METHODS

Research Design

The study used descriptive method, to describe a population or phenomenon being studied. The design includes gathering, analyzing, exploring, and tabulating data.

Population Sampling

Purposive sampling was used in this study. The sample was selected from Colegio de San Juan de Letran Manila.

Respondents of the Study

The respondents of this study are first-year students enrolled in Science Technology and Society (STS) during the first and second semesters of school year 2018-2019 at Colegio de San Juan de Letran Manila.

The course deals with interactions between science and technology, social, cultural, political, and economic contexts that shape and are shaped by them. (CMO No. 20, series of 2013). This interdisciplinary course engages students to confront the realities brought about by science and technology in society CHED (CMO No. 20, series of 2013) Such realities pervade the personal, the public, and the global aspects of our living and are integral to human development. Scientific knowledge and technological development happen in the context of society with all its socio-political, cultural, economic, and philosophical underpinnings at play. This course seeks to instill reflective knowledge in the students that they can live the good life and display ethical decision making in the face of scientific and technological advancement.

The population sample consisted of 200 first-year students from College of Liberal Arts and Sciences, College of Business and Administration, College of Education and College of Engineering and Information Technology who were enrolled in the course (STS) during first and second semester of SY 2018-2019.

Research Instrument

The Awareness of Independent Learning Inventory or (AILI) questionnaire is a reliable and valid instrument to measure metacognitive knowledge, skills, and attitude of students in higher education. The Awareness of Independent Learning Inventory (AILI; Elshout-Mohr 1992; Elshout-Mohr et al. 2004; Meijer et al. 2003; Meijer et al. 2006) assesses not only metacognitive knowledge and regulation, but also metacognitive experiences. The instrument was developed in 2001 to get a self-reported learning related to metacognition. It assesses students self-perceived metacognitive knowledge, skills and attitude that are of concern for students in higher education.

The Awareness of Independent Learning Inventory (AILI) are self-survey questions to measure awareness of independent learning. It consists of 45 statements about metacognitive knowledge, skills, and attitudes in learning.

Table 1. Positive and Negative statements about metacognitive knowledge, skills, and attitudes

Positive statements	Negative statements
1	3
2	4
6	5
7	8
13	9
14	10
15	11
16	12
18	17
19	20
22	21
24	23
30	25
31	26
32	27
34	28
36	29
39	33
40	35
41	37
42	38
43	44
45	

The (AILI) consists of 23 positive statements and 22 negative statements.

Table 2. Areas of Metacognition

Metacognitive Knowledge	Metacognitive Skills	Metacognitive Attitude
1	6	5
2	7	15
11	8	26
13	17	28
16	20	31
21	22	35
23	24	36
27	25	38
30	29	39
32	33	44
37	41	
40	42	
45	43	

The three areas are metacognitive knowledge, skills, and attitude. Metacognitive knowledge is the awareness of one's own cognition and cognitive goals, experiences obtained through cognitive attempts, and process statements. Metacognitive skills are activities that help a person control their own thinking or learning consists of statements. Metacognitive attitude consists of statements about how sensitive and curious students are about themselves (Flavell, 1979; Schraw and Moshman, 1995; Baker and Brown, 1984).

Table 3. The Six-point Likert Scale with corresponding verbal interpretation

Numerical Rating	Range	Verbal Interpretation
1	1.00-1.49	1- Strongly Disagree
2	1.50-2.49	2- Slightly Disagree
3	2.50-3.49	3 -Disagree
4	3.50-4.49	4- Agree
5	4.50-5.00	5- Slightly Agree
6	5.50-6.00	6- Strongly Agree

In this study, the researcher adapted a 6-point Likert type agreement scale ranging from 1 ("strongly disagree ') to 6 ("strongly agree).

Data Gathering Procedure

First-year students from College of Liberal Arts and Sciences, College of Business and Administration, College of Education and College of Engineering and Information Technology who were enrolled in STS during first and second semester of SY 2018-219 answered the instrument. The respondents were told that it will take about 30 minutes to answer the questionnaire. The self-assessment questionnaire would reflect the kind of strategies students use to monitor and access their own learning, to assess metacognitive knowledge, metacognitive skills, and metacognitive attitude levels. Moreover, students were informed that the questionnaire is not a test, therefore, there is no right or wrong and all answers will be kept confidential. Respondents were also instructed not to spend too much time on any specific statement and give the answer which seems to describe how they thought during studying (STS).

Validation/Reliability of Instrument

The instrument used in this study was validated and pilot tested. It was subjected to Cronbach Alpha. It was also examined by three academicians who are experts in the field of science education to address the issue of cultural differences, thus some suggestions were incorporated. The numerical ratings of the responses of the participants were tallied and averaged. Descriptive statistics such as means, and standard deviations were obtained for the items. In addition, pilot testing Cronbach's Alpha, which is a classical measure of reliability was obtained to examine internal consistency. Cronbach Alpha values range from 0 – 1.0. In most cases the value should be at least 0.70 or higher although a value from 0.60 to 0.70 is acceptable. The value of Cronbach's Alpha is .812
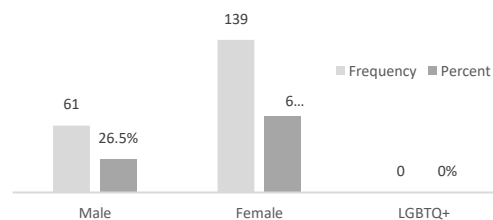
RESULTS AND DISCUSSION

Respondents completed a self-survey designed to assess awareness of independent learning to measure their metacognitive knowledge, metacognitive skills, and metacognitive attitude levels. Respondents were instructed to reflect on their STS classes when responding to the items to provide a basis for answering questions regarding their learning techniques and study habits.

Descriptive analysis was performed on variables relating to metacognitive knowledge, skills, and attitude. After checking the normality of the data as well as removing one outlier (respondent # 25), a one-way analysis of variance or ANOVA was performed to determine if there is a significant
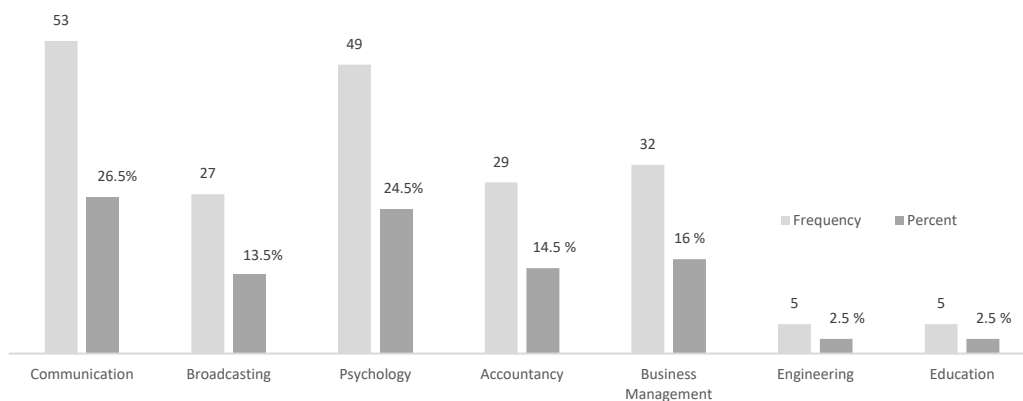
difference between the metacognition of the respondents when grouped according to their academic program and gender. The total sample who participated in this study were 200 first-year collegiate students from College of Liberal Arts and Sciences, College of Business and Administration, College of Education and Engineering and Information Technology and enrolled in the course (STS) during the first and second semester of SY 2018-2019.

Based on Figure 2, the CSJL gender of study population shows that more than half of the respondents were female and are more likely to provide feminine perspective or answer to the survey questionnaire.
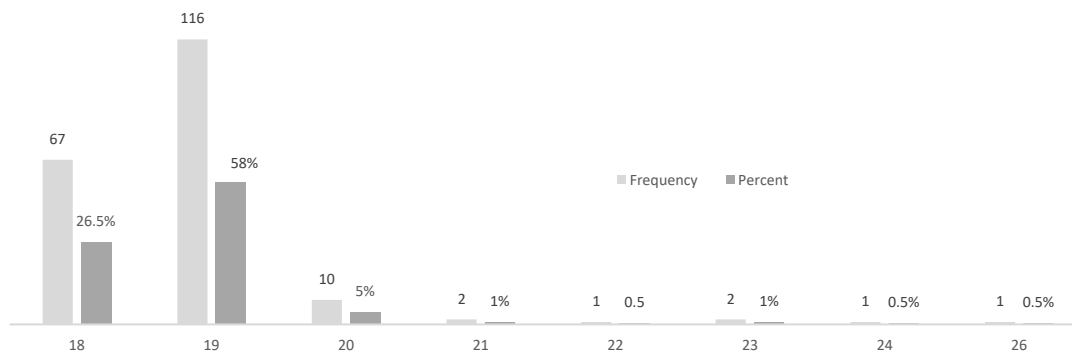
Figure 2. Gender of Study Population

Based on figure 3, most of the respondents were communication students, followed by psychology, business management, accountancy, broadcasting and lastly education and engineering students

Figure 3. Academic Program of the Respondents

Figure 4. Age of the Respondents

Based on figure 4, the age of respondents, it shows that more than fifty percent of the respondents were young adults. The age of the respondents is one of the most important features in understanding their views on the issues, and increasing age indicates levels of individual maturity. The youngest respondent was 18 years old. The oldest respondent was 26 years old.

Table 4. Descriptive Statistics of the Dependent Variables with Gender as the Grouping Variable

	N	Mean	Std. Deviation
Male	61	4.36	.468
Female	138	4.34	.427
Total	199	4.35	.439

Based on table 4, it shows the descriptive statistics of the dependent variable (metacognition) with gender as the grouping variable. The mean or the average is the value that represents all the other observations per batch of concrete while the standard deviation is the average distance of the observations from the mean score. Males with a mean of 4.36 reported slightly higher metacognition than females 4.34.

Table 5. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Metacognition	199	3.3043	5.6087	4.350797	.4391266

The mean or the average is the value that represents all responses of the participants. The standard deviation, on the other hand, is the average distance of the observations from the mean score. Based on Table 5, the overall mean 4.35 and the standard deviation .439.

Table 6. Descriptive Statistics of the Dependent Variables with Academic Program as the Grouping Variable

	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Communication	52	4.466555	.4386964	.0608362	3.5217	5.6087
Broadcasting	27	4.386473	.3945118	.0759238	3.6957	5.2609
Psychology	49	4.371783	.4388453	.0626922	3.3043	5.3913
Accountancy	29	4.283358	.4613938	.0856787	3.3913	5.2609
Business Management	32	4.167935	.4404092	.0778541	3.4348	5.2609
Engineering	5	4.252174	.3415189	.1527319	3.9130	4.8261
Education	5	4.408696	.3920283	.1753204	4.1304	5.0870
Total	199	4.350797	.4391266	.0311289	3.3043	5.6087

Table 6 presents the descriptive statistics of the dependent variable (metacognition) with academic program as the grouping variable. The mean or the average is the value that represents all the other observations per batch of concrete while the standard deviation is the average distance of the observations from the mean score. Table 6 shows that metacognition was rated the highest among communication students 4.46 which fall under the numerical rating of 4.00 with verbal interpretation of agree and standard deviation of .438. On the contrary, the lowest mean was rated among management students 4.16 which fall under the numerical rating of 4.00 with verbal interpretation of agree and standard deviation of .440.

Table 7. ANOVA Statistics of the Dependent Variables with Academic Program as the Grouping Variable

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.020	6	.337	1.788	.104
Within Groups	36.161	192	.188		
Total	38.181	198			

Based on table 7, the result of one-way ANOVA shows that there is no significant difference (i.e., the p value is greater than the .05 level of significance) in the metacognition of the respondents when grouped according to their academic program. As such, there is no need to perform a post-hoc analysis (e.g., Tukey's HSD test).

Table 8. Descriptive Statistics of the Independent Variable with Metacognitive Knowledge as the Grouping Variable

	N	Mean	Std. Deviation
Q1	199	4.69	.830
Q2	199	4.85	.878
Q11A	199	4.20	1.141
Q13	199	3.93	1.000
Q16	199	4.47	1.009
Q21A	199	3.93	1.106
Q23A	199	3.42	.965
Q27A	199	3.56	.940
Q30	199	4.87	1.119
Q32	199	4.11	.867
Q37A	199	3.77	1.130
Q40	199	4.31	.944
Q45	199	4.53	.999
Valid N	199		
Average Mean 4.20			

Based on table 8 the average mean in metacognitive knowledge is 4.20. The highest mean is Q30 4.87, while the lowest is Q23A 3.42. First-year students agree that they have metacognitive knowledge in STS regardless of their programs.

Table 9. Descriptive Statistics of the Independent Variable with Metacognitive skills as the Grouping Variable

	N	Mean	Std. Deviation
Q6	199	4.44	.902
Q7	199	4.24	1.065
Q8A	199	3.76	1.207
Q17A	199	3.84	1.098
Q20A	199	4.10	1.166
Q22	199	4.20	.851
Q24	199	4.43	.992
Q25A	199	3.49	1.128
Q29A	199	3.97	1.108
Q33A	199	3.52	1.105
Q41	199	4.27	.886
Q42	199	4.23	.863
Q43	199	4.42	.866
Valid N	199		
Average Mean 4.07			

Based on table 9, the average mean metacognitive knowledge is 4.07. The highest mean is Q6 4.44, while the lowest is Q33. First-year students agree that they have metacognitive skills in the course STS regardless of the course.

Table 10. Descriptive Statistics of the Independent Variable with Metacognitive attitude as the Grouping Variable

	N	Mean	Std. Deviation
Q5A	199	4.24	1.318
Q15	199	4.03	1.058
Q26A	199	4.01	1.223
Q28A	199	4.16	1.202
Q31	199	4.27	.868
Q35A	199	3.50	1.029
Q36	199	4.14	.983
Q38A	199	4.01	1.251
Q39	199	4.54	1.179
Q44A	199	3.42	1.195
Valid N	199		
Average Mean 4.20			

Based on table 10, the average mean metacognitive skills is 4.03. The highest mean is Q39, 4.54, while the lowest is Q44A 3.42. First-year students agree that they have metacognitive attitude in the course STS regardless of the course.

CONCLUSION

The population sample consisted of 200 first-year students from College of Liberal Arts and Sciences, College of Business and Administration, College of Education and College of Engineering and Information Technology who were enrolled in the course (STS) during first and second semester of SY 2018-2019. Most of the respondents were communication students (26.5%) followed by psychology students (24.5%), business management students (16%), accountancy students (14.5%), broadcasting students (13.5%), and education and engineering students (2.5%). The participants were consisted of 139 (69.5%) females and 61 (30.5%) males. More than half of the respondents were female (69.5%). Male respondents with a mean of 4.36 reported a slightly higher metacognition than female. Majority (58%) of the respondents were 19 years old. The youngest respondent was 18 years old. The oldest respondent was 26 years old. The average age of the respondents was 18.85 years old with a standard deviation of 0. 991.

The results presented significant difference among the scores of (STS) student's metacognition according to course or programs. Metacognition was rated the highest among communication students (4.46) and lowest among

management students (4.16). The overall mean metacognition (4.35) and the standard deviation (0.439) of correspond that first-year students have metacognition. First-year students agree that they have metacognitive knowledge of (4.20), metacognitive skills of (4.07) and metacognitive attitudes of (4.03). in the course STS regardless of their programs.

Metacognitive knowledge, skills and attitudes are very important in students learning. As General Education teachers it is important to acknowledge the role of metacognition in designing and applying different classroom activities that will enhance student's metacognitive knowledge, skills, and attitude that will help STS students increase their abilities to adapt to a new learning task. Teachers should encourage the use of metacognitive cues and prompts during instruction in the classroom so students can develop their own ability to examine their own thoughts and feelings.

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