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Original Research

Predictors of Early Childhood Practice Teachers' Self-Efficacy in Teaching

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Abstract: Self-efficacy is one of several factors that affect prospective and professional teachers' ability to be effective. Teachers' sense of self-efficacy, which is based on the social cognitive theory of Albert Bandura, is crucial to their ability to complete tasks and solve problems in the classroom. Using a predictive research design, the present study aimed to find the personal and academic profile (age, general weighted average, awards, co-curricular and academic competitions participated in, pre-professional learning activities, class size, degree program preference, social role models), student-organization involvements, and institutional policies on mentoring practices as predictors of ninety-eight early childhood practice teachers' self-efficacy in teaching (SET) in state colleges and universities (SUCs) in Region III, Philippines. The adapted twelve-item version of Tschannen-Moran and Woolfolk Hoy's Teachers' Sense of Efficacy Scale was used in the study. Results of the multiple regression analysis showed that the estimated regression model for SET is given by $\hat{y}$ = 45.834 + .114*(Class Size). There was a weak relationship between the two variables, r = .30. The Adjusted R^2 of .082 indicates that class size accounted for 8.2 percent of the variation in SET. Finally, the overall model was statistically significant; $F(1, 96) = 9.633$, p = .003. While this is a relatively low variance, it highlights the importance of considering factors such as class size in understanding and promoting teaching self-efficacy. Cross-validation provides reasonable evidence for the external validity of the generalizability of the regression model to the target population as specified in the research problem.

Keywords: *Early Childhood Practice Teachers, Institutional Policies, Personal and Academic Profile, Self-efficacy in Teaching, Student-Organization Involvements*

Introduction

The relevance of self-efficacy for workers has increased by 62 percent globally in the education and training sector, according to the recently released Future of Job Reports (2023) by the World Economic Forum. A new perspective on how socioeconomic and technical advancements will impact the workplace of the future is provided by the analysis of employer expectations, which looks at how job skills will change over the next five years. According to the report, self-efficacy encompasses motivation, self-awareness, resilience, adaptability, and agility (World Economic Forum 2023). This supports Bhatt's (2020) study, which found that in addition to hard skills, teacher preparation programs such as early childhood education should emphasize students' conceptual and soft skills, such as self-efficacy.

Understanding the predictors of early childhood practice teachers' self-efficacy is vital for teacher education programs and educational institutions. Identifying these predictors can help shape effective strategies and interventions to enhance practice teachers' confidence and

competence in the teaching profession. Consequently, this research aims to explore the key factors that influence early childhood practice teachers' self-efficacy in teaching. The research problem addressed in this study stems from the significant role that self-efficacy plays in teaching effectiveness. Numerous studies have demonstrated the positive correlation between teacher self-efficacy and student achievement, motivation, and engagement (Alhadabi and Karpinski 2019; Garcia-Martin and Garcia-Sánchez 2018). High teacher self-efficacy beliefs are a sign of openness to new ideas, perseverance through difficulties, and the readiness to try teaching methods even if they are deemed rigid (Cerit 2013). However, limited research has focused specifically on the predictors of early childhood practice teachers' self-efficacy, despite their critical role in shaping the future of education and its implications in the teaching–learning process. A study by Yada, Tolvanen, and Savolainen (2018) identifies a pressing need to develop and sustain the self-efficacy of pre-service teachers before they enter the realities of the teaching profession.

In the Philippines, higher education institutions (HEIs) that offer teacher education programs include field studies and practice teaching as terminal experiential courses of the curriculum, referring to an annual commitment that supports authentic experiential learning from field study (observation and assistantship) to actual classroom engagement (internship) for future teachers. With the belief that competent implementation of teacher education curricula and pre-service teacher training are the keys to quality education in the country, the Commission on Higher Education (CHED) and the Department of Education (DepEd) released a joint memorandum order for experiential courses guidelines (CHED-DepEd 2021). In early childhood education, CHED designed a full-packed program curriculum for the Bachelor of Early Childhood Education (BECEd) with a minimum of 158 academic units that aims to develop early childhood pre-service teachers with a solid foundation on developmentally appropriate practices toward the delivery of quality early childhood care and education (CHED Memorandum Order [CMO] No. 76, s. 2017). Aside from mastering hard skills, teachers' soft skills, such as self-efficacy, must also be considered elements in the development of holistic learners in the twenty-first century and the post-pandemic era. Hence, the author of the present study desired to find the personal and academic profile of student-organization involvements and institutional policies as predictors of self-efficacy of the ninety-eight practice teachers under the BECEd Program in state colleges and universities (SUCs) in Region III, Philippines.

Teaching is a complex profession that demands a unique set of skills and competencies. Practice teachers, also known as student teachers, play a crucial role in the preparation and development of future educators. Their effectiveness in the classroom is influenced by various factors, one of which is their self-efficacy in teaching, which is in relation to the standards set by the CHED and in the PPST on the soft skills development of prospective teachers. Self-efficacy, as described by Albert Bandura, is a person's confidence in their capacity to carry out activities. An individual's sentiments, thoughts, motivation, and conduct are all influenced by self-efficacy. This implies that a person's inner beliefs have an impact on their unique skills

and decisions. These beliefs may influence decisions, attempts, perseverance, and emotional and cognitive responses during challenging situations, acting as causal elements in behavior (Bandura 1997; Lippke 2020; Lopez-Garrido 2023). In the context of teaching, practice teachers' self-efficacy directly impacts their instructional practices, classroom management, and overall teaching performance (Hussain and Khan 2022).

In terms of the research gap, the studies on self-efficacy were focused on its effects and significance for in-service and pre-service teachers' performances but not on the predictors of self-efficacy of early childhood practice teachers. On the other hand, the only predictors of self-efficacy that were found were the resilience and positivity of undergraduate students (Bingol et al. 2019), income and citizenship (in the USA) (Amnie 2018) for self-efficacy in coping with stress, and leadership opportunities for leadership self-efficacy (McBrayer et al. 2020). Unfortunately, these have not explored the dimensions of teacher education and practice teaching in particular. By identifying the factors that contribute to early childhood practice teachers' self-efficacy, teacher education programs and institutions can develop targeted interventions to enhance their professional development and ensure their preparedness for the challenges of the classroom. Moreover, understanding these predictors can inform the design of more effective training programs, mentorship initiatives, and support systems to promote the self-efficacy and overall success of practice teachers. Hence, it aimed to explore how the following variables predict early childhood practice teachers' self-efficacy in teaching: age, general weighted average, awards received, co-curricular and academic competitions participated in, pre-professional learning activities, class size, degree program preference, social role models, mentoring sessions with cooperating teachers, mentoring sessions with school heads, student-organization roles, and student-organization activities participated in or organized.

Review of Related Literature and Studies

Self-efficacy in teaching is a crucial factor that influences the effectiveness of early childhood practice teachers in the classroom. Understanding the predictors of self-efficacy is essential for identifying the factors that contribute to their confidence and competence in teaching.

Self-efficacy and Teacher Education

The term self-efficacy was coined and defined by Albert Bandura as an individual's beliefs about their abilities and skills to accomplish assigned tasks. According to Bandura (1997) and Lopez-Garrido (2023), people form their beliefs about their own abilities by interpreting data from four main sources of influence: (a) mastery experiences (performance outcomes), (b) vicarious experiences (social role models), (c) social persuasion, and (d) emotional and physiological states. Academic self-efficacy, which is related to the subject of education, refers to a person's confidence in their ability to solve problems or complete certain tasks at a given

level of capability and ability based on planned and prescribed performances (Bandura 1997). It has been noted that high self-efficacy is linked with numerous benefits to the education sector, such as resilience to adversity and stress among teachers, improved employee performance, and educational achievement (Lopez-Garrido 2023).

Indeed, the role of a teacher in building students' self-efficacy is crucial. Teachers can design and implement a variety of approaches or strategies to establish student self-efficacy (Bertills et al. 2018; Depaepe and Konig 2018). Teachers should also build positive relationships with their students and have a high level of self-efficacy in their own learning (Gerde et al. 2018; Talsma et al. 2018; Zheng, Yin, and Li 2018). According to a study, there is a correlation between teachers' effectiveness and their pupils' academic performance (Swarnalatha 2019). Academic self-efficacy predicts and increases academic achievement in high school and undergraduate students (Alhadabi and Karpinski 2019).

Accounting for workplace demands (teachers' compassion fatigue, work anguish, and children's challenging behaviors), teachers' education, and professional development, teachers' self-efficacy and professional support predicted increased work engagement (Lipscomb et al. 2022). According to Hussain and Khan (2022), believing that challenging activities and situations are difficult and negative is being avoided by teachers with low self-efficacy; they lose confidence in their abilities to accomplish creative and challenging tasks. On the other hand, teachers with high self-efficacy welcome these creative, difficult, and challenging activities and tasks for them to grow, master, and create a deeper understanding of the activities; they accept challenging tasks while developing a high sense of commitment and interest. It has been noted that teachers' attributes, which include attitude, stress, and burnout, are affected by their self-efficacy (Yada, Tolvanen, and Savolainen 2018). Moreover, their teaching self-efficacy and school climate have a direct, positive correlation with their job satisfaction (Karacop and Inaltekin 2022).

Before becoming full-fledged teachers, pre-service experiences have been the training ground for would-be teachers. Teacher education and preparation programs are vital in shaping early childhood practice teachers' self-efficacy beliefs. Recent studies have focused on various aspects of these programs, including coursework, field experiences, and pedagogical training. According to Fernandes et al. (2019), professional learning programs for aspiring teachers had an impact on their motivation, global resilience, self-efficacy, good and negative experiences, work well-being, and work purpose. Bjorklund Jr. et al. (2020) discovered a favorable association between pre-service teachers' self-efficacy and their sense of belonging to the degree program they enrolled in, highlighting the significance of self-efficacy in pre-service teacher training. Additionally, substantial relationships between self-efficacy, resilience, and academic achievement were shown in the study by Supervía, Bordás, and Robres (2022). Unfortunately, pre-service teachers' self-efficacy has been found to increase during the teacher education program but decrease eventually during the first year of teaching employment (Bokhove and Downey 2018). As a result, the

provision of high-quality education from pre-service training through employment depends greatly on the pre-service teachers' self-efficacy. Yada, Tolvanen, and Savolainen (2018) support the idea that self-efficacy should be developed and sustained even before students confront the realities of the teaching profession.

Self-efficacy, Student-Organization Involvement, and Institutional Policies

Researchers have looked at self-efficacy in a variety of educational contexts, including the leadership of undergraduate students and institutional policy formulation. The field of leadership self-efficacy has grown significantly since Bandura's self-efficacy was first studied. According to research by McBrayer et al. (2020), engaging in these activities professionally is a highly significant positive predictor of increases in leadership self-efficacy. In a longitudinal study, Rosch and Collins (2019) found that a student's racial identity had the greatest influence on a student's leadership self-efficacy compared with any other contributing factors. Participating student organizations in volunteering activities is noted in the research on volunteer motivation as a technique to improve social problem-solving skills and self-efficacy (Putwain and von der Embse 2019).

Pre-service teachers' experiences in extra- and co-curricular activities have implications for their future profession. According to Kanar and Bouckenooghe's study in 2021, student participation in a wide range of extracurricular activities was favorably connected with attitudes toward teaching self-efficacy. On the other hand, a study by Wang et al. (2016) demonstrated that despite having lower perceived competence, less efficacious teachers' thirst for knowledge indicates that their sense of efficacy could be increased if they were provided with access to programs that emphasize coaching and mentoring experiences.

Several personal and professional characteristics have been explored in relation to practice teachers' self-efficacy. Selin Tumkaya and Miller's (2020) study finds that pre- and in-service teachers' self-efficacy toward inclusive education is related to their field experience, age, the level at which they are currently teaching, the length of their training, their knowledge of local laws, their confidence in having significant interactions with disabled students in their classes, their level of education, perspectives from various countries, attitude, and their subject of study. Additionally, the research by Infurna, Riter, and Schultz (2018) shows that preschool teachers' ages are positively correlated with their level of teaching efficacy.

This literature review demonstrates that early childhood practice teachers' self-efficacy is associated with multiple constructs, including teacher education programs, student-organization involvements, mentoring and support systems, and personal and professional characteristics. By identifying predictors of early childhood practice teachers, teacher education programs can be designed to enhance self-efficacy beliefs and promote effective teaching practices in early childhood education.

Theoretical Framework

The self-efficacy theory, a division of Albert Bandura's (1997) social cognitive theory, serves as the foundation for this study. According to Bandura, self-efficacy theory describes a person's confidence in their capacity to succeed in particular circumstances or complete a task. This idea holds that individuals with high levels of self-efficacy are more inclined to see obstacles as challenges to be overcome than as dangers to be avoided. Self-efficacy affects a person's drive, effort, and ability to persevere in the face of adversity. The notion of self-efficacy highlights the significance of an individual's beliefs in their own skills in determining their motivation, resilience, and behaviors. Teachers, coaches, and leaders may help people reach their goals and realize their full potential by recognizing and promoting self-efficacy (Bandura 1997).

Individuals develop their self-efficacy beliefs by interpreting information from four main sources of influence: (a) mastery experiences (performance outcomes), (b) vicarious experiences (social role models), (c) social persuasion, and (d) emotional and physiological states (Bandura 1997; Lopez-Garrido 2023). Bandura (1997) found that mastery experiences, or people's past performance outcomes, are the most influential factors that influence people's self-efficacy. The core ideas of self-efficacy, according to Hussain and Khan (2022), must be understood by educators and teachers. It is best to allow teachers to specialize in what they do best. As teachers in this situation achieve results on their own, the mastery experience increases their self-efficacy. Successful efforts, according to Albert Bandura (1997), promote teacher self-efficacy. Therefore, by conducting workshops and training sessions, teachers' mastery experience can be improved (Hussain and Khan 2022). With this, the present study includes practice teachers' performances, outcomes, training sessions, and the like, such as their general weighted average (GWA) from the first year to the third year, awards received, academic competitions participated in, and pre-professional learning activities. This aligns with the findings of the study by Kanar and Bouckenooghe (2021), which demonstrate a positive correlation between perceptions of employment self-efficacy and the range of extracurricular activities that students participated in.

On the other hand, as future instructional leaders, early childhood practice teachers' involvement in student organizations, such as roles and participation in activities and programs initiated by student organizations, which require soft skills and confidence that can develop higher self-efficacy, has been studied. Bandura (1997) posits that self-efficacy can increase or decrease motivation and is an important factor in effective leadership. On the other hand, since student organizations are also involved in volunteerism, the study of volunteer motivation provides a way to enhance social problem-solving ability and self-efficacy (Putwain and von der Embse 2019).

According to Bandura (1997) and Lopez-Garrido (2023), individuals with sustained efforts and the belief that they too possess comparable skills, capabilities, and abilities of a successful person in the same field are likely to succeed. For vicarious experiences, the study includes practice teachers' social role models (e.g., immediate family members, relatives, friends,

counselors, teachers, coaches, mentors, cooperating teachers, and resource teachers) in the education sector, both here and abroad. Based on Joint CHED-DepEd Memorandum Order 1, Section 2021, practice teachers should be mentored as part of the roles of the cooperating teacher and school head. Thus, the frequency of mentoring sessions conducted by the cooperating teacher (CT) and school head for the practice teacher have been included for investigation in the study. This aligns with Lopez-Garrido (2023), who note that a third source of self-efficacy makes it more likely that people will believe that they have the knowledge and ability to achieve when they receive encouraging verbal feedback while carrying out tasks.

The socio-emotional, moral, physical, and psychological well-being of people can influence how they feel about their skills in a certain situation, according to Lopez-Garrido (2023). In addition, as noted by Ma, Chutiyami, and Nicoll (2021), teacher self-efficacy remains one of the most important psychological paradigms to understand teachers' motivation. Additionally, the research by Infurna, Riter, and Schultz (2018) shows that preschool teachers' ages are positively correlated with their level of teaching efficacy. Thus, the practice teacher's belief that she will perform well in teaching may be influenced by her degree program preference, age, and class size.

In the present study, teacher self-efficacy can be improved among early childhood practice teachers once respondents' personal, academic, and institutional factors have been identified and used as the basis for instructional, research, and extension activities and programs in HEIs. The framework in Figure 1 shows personal and academic, student-organization involvements, and institutional policies as variables that may predict the self-efficacy of teacher education students, particularly early childhood practice teachers who are expected to deliver developmentally appropriate practices in the most crucial and formative years of children's lives.

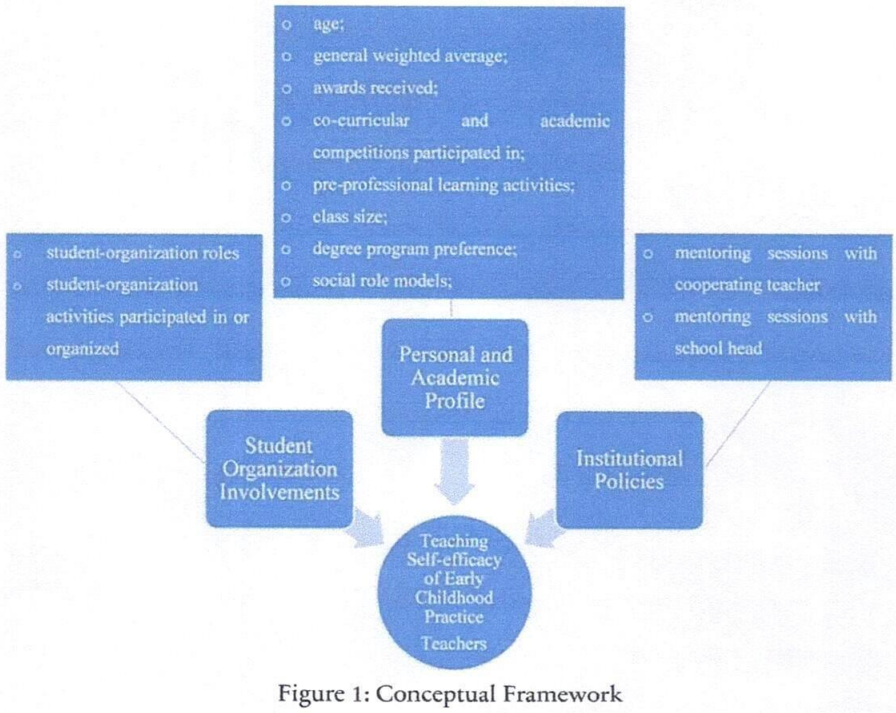

Figure 1: Conceptual Framework

As independent variables, the personal and academic profiles of the respondents include age, GWA from the first year to the third year, awards received, academic competitions participated in, pre-professional learning activities, class size, BECED as degree program preference, and social role models in the education sector. Student-organization involvement includes roles and their participation in various activities. Lastly, the institutional policies of state universities and colleges (SUCs) in Region III include mentoring sessions. These independent variables were used as predictors of practice teachers' self-efficacy in teaching in the Bachelor of Early Childhood Education (BECEd) program at state colleges and universities (SUCs) in Region III, Philippines. The self-efficacy of early childhood practice teachers was the dependent variable, which was measured through a validated and adopted instrument.

Methods

Participants

The population for the study comprised the 186 teacher education students enrolled in the Teaching Internship course during the AY 2022 to 2023 under the BECED Program in the state universities and colleges (SUCs) in Region III (Bataan Peninsula State University [BPSU], Bulacan State University [BSU], Central Luzon State University [CLSU], and Tarlac Agricultural University [TAU]). The sample size of ninety-eight practice teachers enrolled in the Teaching Internship course in the Bachelor of Early Childhood Education Degree Program in the SUCs in Region III are the respondents to the study.

Data gathered shows that most of the early childhood practice teachers were aged 21 to 22 (65.31%), with one or two social role models (65.31%), and preferred to take BECED as their degree program (65.31%); the majority have a GWA of 1.51 to 2.00 (75.51%); and half of them have a class size of eleven to thirty (50%). Also, most of the respondents have one to four hours of mentoring sessions with cooperating teacher (55.1%) and one to two hours with school head (80.61%). On the other hand, very few have participated in at least one competition (7.14%) and received at least one award (5.1%). Meanwhile, most of them have participated in one to five pre-professional activities (63.27%). In terms of student-organization involvements, most of the early childhood practice teachers are members of student organizations (71.43%), while few have been officers (28.57%). Moreover, most of the practice teachers have participated in one or two student-organization activities (56.12%).

Sampling and Sampling Technique

The sample size for multiple regression analysis with twelve predictors based on a .05 level of significance, .80 power, and effect size of .20 was computed at 98, using power analysis with the aid of G*Power version 3.1.9.4. Simple random sampling was used through the lottery method to get the sample size of 98. TAU and BPSU are slightly overrepresented, with 30

(30.6%) and 33 (33.7%) respondents, respectively, while the other two SUCs are underrepresented, with 16 (16.3%) for CLSU and 19 (19.4%) for BSU.

For the test data set, forty-two samples were randomly selected from those who were not selected to be the train data set. The test data set was used in the validation of the model using the holdout method, which is a common technique used in the cross-validation of models in regression analysis. The training set ($n1 = 98$) was used to build the regression model, while the testing set ($n2 = 42$) was used to evaluate the performance of the model.

Research Design

The predictive design was used to answer the questions of the study. The design is used because it examined age, GWA, awards, co-curricular and academic competitions participated in, pre-professional learning activities, class size, degree program preference, social role models, mentoring sessions with cooperating teachers, mentoring sessions with school heads, student organizations, and student-organization activities participated in or organized by the early childhood practice teachers to see if these could significantly predict their self-efficacy in teaching.

Validity and Reliability of Sources of Data

The data on personal and academic profiles, student-organization involvements, and institutional policies was elicited through the researcher-made questionnaire. Teaching self-efficacy levels of the early childhood practice teachers were measured through an adapted teacher self-efficacy scale, the Teacher Sense of Efficacy Scale (TSES), formerly known as the Ohio State Teacher Efficacy Scale. From a nine-point to a five-point Likert scale, the TSES was altered. Additionally, a contextualized sentence structure was included to the TSES to help with the respondents' comprehension.

The researcher-designed questionnaire was used to elicit information from the respondents on their personal and academic profiles, student-organization involvements, and institutional policies. The content of the researcher-designed questionnaire was validated by an expert in teacher education. Megan Tschannen-Moran and Anita Woolfolk Hoy created the TSES, formerly known as the Ohio State Teacher Efficacy Scale. The twelve-item short variant of the TSES was used to gauge teachers' perceptions of their own efficacy. This tool captures teachers' efficacy beliefs and is regarded as valid and trustworthy. For the short form, all items put on this factor ranged from .49 to .75. The twelve-item form's total score can be used to evaluate effectiveness because its reliability was .90. The twelve-item instrument was the suggested form for practice teachers (Tschannen-Moran and Woolfolk 2001). Aside from the validation conducted by the authors of the original instrument, it underwent pilot testing. The present research conducted a pilot test with thirty practice teachers in Region 3, Philippines, who are teaching at the primary level. The result of the Cronbach alpha was 0.86, which is a good reliability value next to excellent (.90). In addition, the content of the adapted TSES was validated by an expert in teacher education.

Ethical Considerations

The researcher complied with all ethical standards for the study, including informed permission, the opportunity to withdraw, the confidentiality of the participants' personal information, and other replies deemed confidential. The Data Privacy Act of 2012 was followed when handling the collected data. The files were stored in the researcher's personal laptop, which is password-protected and known only to the researcher. In order to protect anonymity, participant names were also replaced with chosen pseudonyms.

Scope and Delimitation

The scope of the study includes the extent of the prediction of early childhood practice teachers' personal and academic profiles, student organization involvements, and institutional policies on their self-efficacy in teaching. Specifically, personal and academic profiles include age, general weighted average, awards, co-curricular and academic competitions participated in, pre-professional learning activities, class size, degree program preference, and social role models. On the other hand, student organization involvements include student organization and student organization activities participated in or organized. Finally, institutional policies include mentoring sessions with cooperating teachers and mentoring sessions with school heads. Likewise, this study is limited only to the early childhood practice teachers of state universities and colleges (SUCs) from Region III during the academic year 2022 to 2023 who are taking teaching internships. The responses on GWA were verified by the teaching internship coordinators of the respective SUCs. Due to the dispersed locations of the practice teachers in different public schools in Region 3, the data for this study was collected via an online survey administered to practice teachers. While efforts were made to ensure the accuracy and completeness of the data, some responses may not be entirely reliable due to the lack of validation.

Data Gathering Procedure and Analysis

The researcher sought permission from the university presidents for the conduct of the study. Upon approval, the questionnaires were sent to the respondents' institutional emails with the aid of the respective institutions. A Google Form was utilized since the practice teachers are deployed in different schools in Region 3 for teaching internships. The responses of the respondents were retrieved after they submitted the Google form.

Multiple linear regression was used to predict early childhood practice teachers' self-efficacy in teaching. The outcome variable (SET) is the sum of self-efficacy in teaching using the TSES. The explanatory variables are age, GWA, awards, co-curricular and academic competitions participated in, pre-professional learning activities, class size, degree program preference, social role models, mentoring sessions with cooperating teachers, mentoring sessions with school heads, student organization, and student-organization activities participated in or organized. All statistical analyses were performed using Jeffrey's Amazing Statistics Program (JASP).

Preliminary Assessment

To have a valid result using multiple regression analysis, the data was checked to make sure that it could actually be analyzed using multiple regression. As part of the preliminary assessment, as shown in Table 1, Pearson's *r* correlation analysis was conducted to examine the relationship or linearity between early childhood practice teachers' teaching self-efficacy and personal and the independent variables as one of the assumptions of multiple regression analysis.

Table 1: Relationship of Early Childhood PTs Self-efficacy in Teaching to Personal and Academic Profile, Student-Organization Involvements, and Institutional Policies

Variables	*r*	*p*
Age	−0.126	.215
Social Role Models	−0.144	.156
General Weighted Average	−0.248*	.014
Class Size	0.302**	.003
Mentoring session with CT	0.053	.601
Mentoring session with School Head	0.065	.526
Co-curricular/Academic Competitions Participated in	−0.108	.290
Pre-professional Learning Organized/Participated in	−0.015	.881
Co-curricular/Academic Awards Received	−0.050	.624
Student-organization activities participated in or organized	−0.020	.842
BECED as Degree Preference	0.030	.772
Role in student organization or association	−0.002	.984

* $p < .05$, ** $p < .01$.

Results indicated a significant positive correlation between early childhood teachers' teaching self-efficacy and class size ($r = .302$, $p = .003$). This suggests that as the class size increases, teaching self-efficacy also tends to increase, but the degree of relationship is considered weak. On the other hand, the results indicated a significant negative correlation between early childhood teachers' teaching self-efficacy and the GWA ($r = -.248$, $p = .014$). This suggests a weak relationship between the variables, indicating that as GWA increases, teaching self-efficacy tends to decrease. Since only class size and GWA are the variables that have a significant linear relationship with the teaching self-efficacy of early childhood practice teachers, only these two variables were included in model development.

Model Development

In this stage, a stepwise multiple regression method was used. This method is used to select the most important predictors for inclusion in a regression model. The purpose of the stepwise method is to identify the most significant predictors of the outcome variable, while controlling for other variables in the model. The stepwise method involves an iterative process of adding and removing predictor variables based on their statistical significance. As shown in Table 2, the result of the analysis generated from the JASP software provides only

one model, with class size being the only predictor of early childhood practice teachers' self-efficacy in teaching (p = .003). The GWA of the early childhood practice teachers was not included in the model because it could not significantly predict their teaching self-efficacy.

Table 2: Coefficients of Predictors

Model		*Unstandardized*	*Standard Error*	*Standardized*	*t*	*p*
1	(Intercept)	49.694	0.484		102.766	<.001
2	(Intercept)	45.834	1.327		34.531	<.001
	Class size	0.114	0.037	0.302	3.104	.003

Note: The following covariate was considered but not included: General Weighted Average.

Model Diagnostics

Model diagnostics is a critical step in regression analysis, as it involves checking the assumptions and the fit of the model to the data. In this stage, a check for the independence of errors was performed. Another assumption of regression analysis is that the errors (residuals) are independent of each other. Based on the results of the analysis, the residuals are independent of each other since the Durbin–Watson statistic value (1.842) lies within the range of 1.5 to 2.5, which is considered as the threshold for no autocorrelation.

Under model diagnostics, a check for the normality of residuals was also performed. Figure 2 shows that the residuals are approximately normally distributed. The next step was checking for homoscedasticity, also known as homogeneity of variance. The homoscedasticity was checked using the scatterplot (Figure 3). Since the plot shows a random scatter of points around zero with no discernible pattern, the assumption of homoscedasticity was met. Furthermore, the plot shows no clear pattern, such as a funnel shape or a U shape.

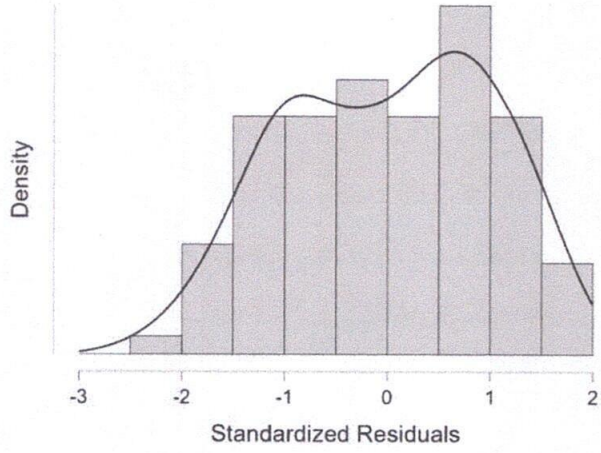

Figure 2: Standardized Residuals Histogram

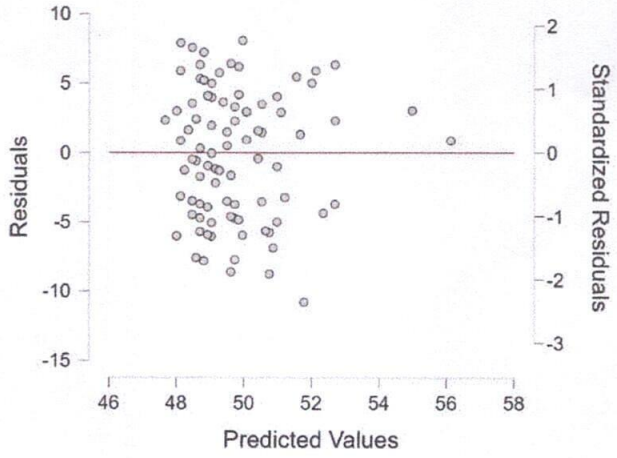

Figure 3: Scatterplot of Residuals vs. Predicted

Another assumption check was for outliers and influential observations. The analysis indicated that there were no significant outliers, high leverage points, or highly influential points since the Cook's Distance values were less than one. Finally, multicollinearity was not performed because it is a concern only when there are two or more predictors in the regression model. When there is only one predictor, the question of multicollinearity is not relevant because there are no other predictors to be correlated with.

Model Validation/Cross-Validation

The last process was model validation using the holdout method. To determine the level of generalizability of the model, the final model was used to predict the SET of a new set of randomly selected sample. Pearson *r* was calculated between the actual and the predicted values of SET of the new data set.

Results

As shown in Table 3, the overall mean (*M*) and median SET of sampled early childhood practice teachers are 49.7 (*SD* = 4.8), which is high, and 50, respectively. On average, younger practice teachers (21–22 years old) had a higher SET than older ones (25 and above) by 1.9. In terms of the GWA, practice teachers with 1.00 to 1.50 GWA had the highest SET (*SD* = 4.8, *Md* = 53). Likewise, early childhood practice teachers with a large class size (51–70) posted a high SET of 53.5 (*SD* = 5.8, *Md* = 56). On the other hand, class size is significantly related to practice teachers' self-efficacy, with *p*-value of .003, which rejects the null hypothesis.

Table 3: Descriptive Statistics for SET

Practice Teachers' Profile	*Description*	*M*	*SD*	*Median*
Age	21–22	50.1	5.0	51
	23–24a	49.0	4.1	48
	25 and above	48.2	5.2	48
Number of Social Role Models	None	50.5	4.5	50
	1–2	49.7	5.0	49.5
	3–4	47.2	4.1	45
Gwa	1.00–1.50	52.3	4.8	53
	1.51–2.00	49.3	4.9	49
	2.01–3.00	49.5	3.3	48
BECED as Degree Preference	Yes	49.8	4.8	50
	No	49.5	4.9	49.5
Class Size	11–30	48.9	4.4	48
	31–50	49.7	4.6	50
	51–70	53.5	5.8	56
Mentoring Session with Cooperating Teacher (Hr/Week)	1–4	49.6	4.3	49
	5–8	49.2	5.3	49
	9 or more	51.3	5.3	53
Mentoring Session with School Head (Hr/Week)	1–2	49.6	4.8	49
	3–4	50.4	4.1	50
	5–6	49.5	7.5	49.5
Number of Co-curricular /Academic Competitions Participated in	None	49.8	4.8	50
	1–2	48.3	5.2	47
Number of Pre-professional Learning Activities Organized/Participated in	None	50.9	5.3	51
	1–5	49.4	4.5	49.5
	6 or more	49.9	5.4	51
Number of Co-curricular/Academic Awards Received	None	49.7	4.6	50
	1	50.8	7.4	54
	2 or more	47.5	5.8	47.5
Student Organization Role	Member	49.7	4.7	50
	Officer	49.7	5.2	49.5
Number of Student-Organization Activities Participated in or Organized	None	50.2	5.0	51
	1–2	49.5	4.8	50
	3 or more	49.6	4.9	48

Table 4: Overall Regression

	Sum of Squares	*df*	*Mean Square*	*F*	*p*
Regression	202.700	1	202.700	9.633	.003
Residual	2020.117	96	21.043		
Total	2222.816	97			

$R = .302$; $R^2 = .091$; Adjusted $R^2 = .082$; RSME = 4.587.

Table 5: Coefficients of the Predictors

	Unstandardized	*Standard Error*	*t*	*p*	*Remarks*	*Decision*
(Intercept)	45.834	1.327	34.531	<.001	Significant	Reject H_0
Class Size	.114	.037	3.104	.003		

Discussions

Self-efficacy refers to a person's beliefs about their ability to accomplish tasks. Self-efficacy influences an individual's feelings, thoughts, motivation, and behavior. This means that an individual's inner beliefs influence their personal abilities and decisions. These beliefs can act as causal factors in behavior by influencing choices, efforts, persistence, and cognitive and emotional reactions in times of difficulty (Bandura 1997; Lippke 2020, Lopez-Garrido 2023).

Self-efficacy is essential for completing tasks and goals in the field of education as well as for teachers to overcome problems in their instruction. Teacher self-efficacy refers to a person's level of confidence in their ability to successfully carry out actions to produce results or in their own talents to teach effectively. High levels of self-efficacy in teachers are a sign of receptivity to new ideas, tenacity in the face of challenges, and willingness to try instructional strategies even if they are thought to be risky (Cerit 2013). Hussain and Khan (2022) claim that instructors with low self-efficacy avoid demanding activities and situations, believing them to be tough and negative and because they lose faith in their ability to complete imaginative and difficult tasks. On the other hand, in order to learn, master, and secure a firm grasp of the activities, teachers with high self-efficacy welcome these innovative, difficult, and challenging tasks and activities. They accept difficult tasks while fostering a strong sense of dedication and interest (Klassen et al. 2011; Mojavezi and Tamiz 2012; Yada, Tolvanen, and Savolainen 2018).

This study aims to investigate the personal and academic profile (age, GWA, awards, co-curricular and academic competitions participated in, pre-professional learning activities, class size, degree program preference, social role models), student-organization involvements (student-organization and student-organization activities participated in or organized), and institutional policies (mentoring sessions with cooperating teachers and mentoring sessions with school heads) as predictors of self-efficacy of the ninety-eight practice teachers under the Bachelor of Early Childhood Education (BECEd) Program in SUCs in Region III, Philippines.

Practice teachers' self-efficacy in teaching levels was comparable regardless of their degree preference, frequency of mentoring sessions with school heads, number of student-organization activities participated in or organized, role in student organizations, number of co-curricular and academic competitions participated in, and number of pre-professional learning activities organized or participated in. Interestingly, the highest mentoring session with cooperating teachers (nine or more hours per week) of the practice teachers had the highest SET at 51.3 ($SD = 5.3$, $Md = 53$).

As presented, there was a weak relationship between the two variables, $r = .30$. The Adjusted R^2 of .082 indicates that class size accounted for 8.2 percent of the variation in SET. The other unexplained portion of the variation in SET (i.e., 91.8%) can be explained by other variables not included in the model. It was found that class size significantly predicted early childhood practice teachers' self-efficacy in teaching ($t(96) = 3.104$, $p = .003$). Finally, the overall model was statistically significant, $F(1, 96) = 9.633$, $p = .003$.

On the other hand, as shown in the previous section, the estimated regression model for self-efficacy in teaching is given by $\hat{y} = 45.834 + .114^*$(Class Size). The model indicates that SET increases by a .114 increase per unit in class size. Cross-validation using a new set of forty-two randomly selected samples generated a statistically significant Pearson r of .45 ($p = .003$), which signifies a moderately positive relationship between the observed and predicted values of the DV. Moreover, the two data sets share 20.25 percent (i.e., [.45]2 × 100 = 20.25%) common variance, which could be considered reasonable evidence for the external validity of the generalizability of the regression model to the target population as specified in the research problem.

The discovery that only class size significantly predicted early childhood practice teachers' self-efficacy in teaching is remarkable. According to these results, early childhood practice teachers' perceptions of their own teaching abilities are significantly influenced by the size of their classes. This means that even in large class sizes, early childhood practice teachers with high levels of self-efficacy in teaching can address disruptive behavior in the classroom, persuade kids to follow rules, inspire students to do well on their schoolwork, and establish a classroom management system with each group of students.

It is noteworthy that only class size substantially impacts early childhood practice teachers' self-efficacy in teaching. These findings suggest that class size is an important factor in shaping teaching self-efficacy among early childhood practice teachers. According to Kelly and Scafidi (2013), financial concerns are among the most frequently raised objections to decreasing class sizes. School districts hold that it would be too expensive for them to reduce class size. With regard to the importance of class size in teaching practices, Almulla (2015) found that teachers consider class size as one of the most important aspects that influence a number of practices in the classroom. Larger class sizes might have a negative impact on teachers' confidence in their ability to instruct. This is because larger class sizes frequently lead to increased workload, less individualized attention for every student, and a more difficult setting for classroom management. These elements may make teachers feel overburdened, stressed out, and less confident in their capacity to instruct. However, research shows that administrators frequently increase the class sizes of the most effective teachers in order to ensure higher student test scores (Barrett and Toma 2013). This is contrary to the idea that administrators should reward effective teachers by reducing their class sizes. Hence, teacher self-efficacy comes into play. Since they enhanced class size, which depicts teaching effectiveness, their efficacy in teaching is increasing. Hussain and Khan (2022) argue that teachers with high self-efficacy welcome these creative, difficult, and challenging activities and tasks for them to grow, master, and create a deeper understanding of the activities; they accept challenging tasks while developing a high sense of commitment and interest. This is why the result of the regression analysis is positively significant, which means that as the class size increases, the teaching self-efficacy of the early childhood teachers increases. More specifically, teachers with higher levels of self-efficacy are more likely to persevere through

setbacks or to use a broader variety of teaching methods, which may be better adapted to the unique and various issues they confront in the classroom, such as large class sizes (Lauermann and ten Hagen 2021). They are willing to accept challenging tasks, such as large class sizes, during their practice teaching journey.

Undoubtedly, for many, when it comes to class size, smaller classes are often considered more conducive to effective teaching and learning, as they allow teachers to provide more individualized attention to each student and to create a more interactive and collaborative classroom environment. This, in turn, may contribute to teachers' sense of competence and self-efficacy. On the other hand, larger classes may present challenges in terms of classroom management and may make it more difficult for teachers to meet the needs of all students, which could negatively affect their sense of self-efficacy. Hence, it is worthwhile to investigate this factor in further studies.

Overall, class size may be among several factors that contribute to teachers' self-efficacy, and, hence, further research is needed to better understand the complex relationship between class size and teachers' self-efficacy and to identify effective strategies for promoting teacher self-efficacy in various classroom contexts.

Conclusion and Recommendations

It was concluded that class size was a significant predictor of early childhood practice teachers' self-efficacy in teaching. Overall, the model was statistically significant and explained 8.2 percent of the variance in early childhood teachers' self-efficacy in teaching. While this is a relatively low variance, it highlights the importance of considering factors such as class size in understanding and promoting teaching self-efficacy. Furthermore, cross-validation provides reasonable evidence for external validity of generalizability of the regression model to the target population as specified in the research problem.

On the basis of the summary and conclusions of the study, the researcher offered the following recommendations: (a) the early childhood practice teachers should continue to accept challenges on large class size, produce very satisfactory academic outcomes and high self-efficacy in teaching; (b) the cooperating teachers and cooperating school heads should guide the early childhood practice teachers in handling large class sizes and promote positive outlook on this dimension of teaching internship experience; (c) HEIs and administrators should continue to commission researches on the teaching self-efficacy to craft relevant and expedient institutional policies; (d) HEIs and administrators should endeavor to increase opportunities for pre-professional learning activities and academic and co-curricular competitions of early childhood pre-service teachers; (e) researchers should continue to investigate factors that influence teaching self-efficacy of early childhood teachers focusing on other variables of the other dimensions of the studied variables; (f) while the results of this study suggest that class size is an important factor in teacher self-efficacy and the other studied

variables do not have influence, it is important to note that the data was collected through an online survey and lacks validation except for GWA. Future research should seek to address this limitation by using more robust data collection methods; and (g) qualitative research design may also be used to look for the qualitative dimensions of early childhood practice teachers' self-efficacy in teaching.

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The author declares that generative AI or AI-assisted technologies were not used in any way to prepare, write, or complete essential authoring tasks in this manuscript.

Informed Consent

The author has obtained informed consent from all participants.

Conflict of Interest

The author declares that there is no conflict of interest.

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Kindergarten Pupils' Birth Order and Achievement in Domains of Early Childhood Development in Camiling Central District of Philippines

Rene G. Nanit

ABSTRACT

This study aimed to determine the relationship between kindergarten pupils' birth order and achievement in domains of early childhood development at Camiling Central District for the school year 2017-2018 and significant difference in their performance in terms of their birth order. The descriptive- comparative-correlational design was used in the study. A total of 221 kindergarten pupils' birth order was correlated to their achievement in the seven domains of early childhood development: gross motor, fine motor, self-help, receptive and expressive, cognitive, and socio-emotional. Also, a significant difference in the performance of pupils in the domains in terms of birth order was analyzed. Statistical results revealed that there is no significant relationship between kindergarten pupils' birth order and their achievement in domains of early childhood development. However, there is a significant difference in the performance of kindergarten pupils in terms of birth order. Based on the findings of the study, it implies that kindergarten teachers should consider kindergarten pupils' birth order in providing them with learning activities, experiences, and opportunities for the possible improvement of their domains of early childhood development.

Keywords: *Kindergarten pupils, Birth order, Domains of early childhood development*

INTRODUCTION

The National Association for the Education of Young Children considers the teacher's role in supporting children's development as one of their top fundamental principles. Children must function in all the early childhood developmental domains (i.e. physical, social, emotional and cognitive) if they are to successfully adapt to school and societal norms. These domains are empirically related and inextricably intertwined in early childhood. Kindergarten is a crucial year where learners' experiences nurture positive approaches to learning and this prepares children for the more rigid academic expectations of the elementary grades (Copple and Bredecamp, 2009). The Department of Education believes kindergarten is a transition stage between informal literacy and formal literacy (Grade 1-12). This is the time of greatest growth and development, when the brain develops most rapidly, if not, at

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its fullest. It is a period when talking, walking, self- esteem, vision of the world and moral foundations are being established. These children at this stage should be immersed with play, activities, and games to naturally acquire the skills appropriate for their holistic development as emergent literates and be ready for formal school.

The Kindergarten Education Act or the RA 10157 supports NAEYC's mission to nurture positive approaches to learning and prepare children to naturally acquire the skills and competencies appropriate for their holistic development. Therefore, kindergarten teachers should guide and facilitate the learners using an engaging and creative curriculum that is developmentally appropriate. Moreover, teachers may also consider biological factors in attaining holistic development of kindergarten pupils like their birth order.

This study aimed to determine the relationship between kindergarten pupils' birth order and achievement in domains of early childhood development at Camiling Central District for the school year 2017-2018 and significant difference of their performance in terms of their birth order. Specifically, it aims at:

1. Describing kindergarten pupils in terms of their:
   birth order; sex; and domains of early childhood development;
2. Finding significant relationship of kindergarten pupils' birth order and their achievement in domains of early childhood development;
3. Finding significant difference in performance of kindergarten pupils in terms of their birth order; and
4. Drawing implications from the results of the study to kindergarten education.

METHOD

To determine if there is a significant relationship between kindergarten pupils' birth order and their achievement in domains of early childhood development, descriptive-comparative-correlational design was used. In descriptive research, variables are studied, as they exist in their setting. No experimental variables are manipulated and the main concern is to describe the status, profile, incidences or occurrences of the variables (Sicat, 2009). With this, the study looked for the learners' birth order and achievement in domains of early childhood development. Thus, this design was appropriate for the study. On the other hand, comparative research attempts to determine the differences between or among groups or individuals. With this, since the present study looked for the difference in achievement of kindergarten pupils in terms of birth order, this design is appropriate. Lastly, correrational research explores the relationship between or among variables. The variables are studied without any attempt to control or manipulate them. The study aimed at finding if there was

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significant relationship between kindergarten pupils' birth order and their achievement in domains of early childhood development. Thus, this design is also appropriate.

The kindergarten pupils in 10 schools of Camiling Central District during the school year 2017 – 2018 will be the subjects of the study. The population of 492 was reduced to 221 as sample size using simple random sampling technique through Slovin's formula at 0.05 alpha level. The data were elicited through the results of final assessment of the Early Childhood Development Checklist, the instrument used by kindergarten teachers in the public schools. The Checklist is divided into 7 domains: Gross Motor, Fine motor, Self-Help, Receptive Language, Expressive Language, Cognitive and Social-Emotional. For ethical concerns, consent was secured from the parents of the kindergarten pupils.

Simple frequency counts and percentage were used to analyse data for the study. In identifying the correlation of the birth order and domains of early childhood development of kindergarten pupils, the Chi-square test was used. Meanwhile, Analysis of Variance was used to determine the significant difference in performance of kindergarten pupils in terms of their birth order. Tables and figures were utilized to give the reader a comprehensive picture of the gathered data and information.

RESULTS AND DISCUSSION

Description of Kindergarten Pupils

The kindergarten pupils were described in terms of their birth order and achievement in domains of early childhood development. Birth order refers to the chronological order of sibling births in a family. The birth order of the kindergarten pupils in the district was collected. Sex refers to gender. It is either of the two main categories (male and female) into which humans are divided on the basis of their reproductive functions.

Table 1: Birth Order of the Kindergarten Pupils in the Camiling Central District

Birth Order	**No. of Pupils**	**Percentage (%)**
Last-born	74	33.48
First-born	61	27.60
Middle-born	582	6.24
Only child	28	12.68
	N=221	100

Table 1 shows that majority (33.48%) of the pupils were last-born, 27.60% were first-born children, and 26.24% were middle-born children. Only few (12.68%) were only child of their parents.

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Table 2. Sex aggregation of the Kindergarten Pupils in the Camiling Central District

Birth Order	**Male**	**Female**
Last-born	35	39
First-born	22	39
Middle-born	28	30
Only child	17	11
Total	**102**	**119**

Table 2 shows that there are more last-born and first-born females than male pupils. However, inside the kindergarten classrooms, there are more middle-born and only child male pupils than female ones. As a whole, there are more female kindergarten pupils than males.

Domains of Early Childhood Development

The achievement of the kindergarten pupils were described in terms of their performance in the seven domains – gross motor, fine motor, self-help, receptive language, expressive language, cognitive and socio-emotional. The performances were assessed through the Early Childhood Development Checklist, an instrument used by kindergarten teachers in public schools. The instrument is being administered at two assessment periods within a year to measure the development of the pupils. The data presented below is the result of their second and final assessment.

Table 3. *Achievement of the Kindergarten Pupils in Domains of Early Childhood Development*

	Suggest Significant delay in overall development		Suggest slight delay in overall development		Average development		Total		Mean	Verbal Description
Domains	F	%	F	%	F	%	F	%		
Gross Motor	0	0	12	5.43	209	94.57	221	100.00	2.95	Average development
Fine Motor	1	0.45	1	0.45	219	99.10	221	100.00	2.99	Average development
Self-help	0	0	12	5.43	209	94.57	221	100.00	2.95	Average development
Receptive Language	1	0.45	1	0.45	219	99.10	221	100.00	2.99	Average development
Expressive Language	0	0	40	18.10	181	81.90	221	100.00	2.82	Average development
Cognitive	0	0	9	4.07	212	95.93	221	100.00	2.96	Average development
Socio-emotional	0	0	9	4.07	212	95.93	221	100.00	2.96	Average development

Table 3 shows that the achievement of kindergarten pupils in all domains of early childhood development is average. With this, we can interpret that most of them are

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in normal development since most of the indicators in each domain of early childhood development, if not all, were correctly performed by the kindergarten pupils.

Gross motor refers to the child's ability to control and coordinate body movements involving large muscle groups (Jacobson, 2011). Crawling, walking, running, skipping, jumping, and climbing are all examples of gross motor skills. During the assessment, most among the skills/activities prescribed by the checklist, gross motor domain was successfully accomplished. Some of these skills/activities were: climbing on chair or other elevated piece of furniture like a bed without help, walking backward, running without tripping or falling, walking upstairs with alternate feet without holding handrail, and moving body part as directed. With this, it is interesting to note that there is minimal problem in the gross motor development of the kindergarten pupils because in the study of Piotrkowski, Botsko, and Matthews (2000), they found in a survey of kindergarten teachers that good health was one of the factors perceived to be essential to school readiness. In addition, issues of physical fitness are rarely addressed in state standards items, despite their clear importance to long-term health outcomes. Half of the physical well-being and motor development items cataloged by Scott-Little, Kagan and Frelow (2005) addressed motor skills, but only 11.5 percent addressed fitness.

In terms of fine motor skills, almost all of the pupils attained average development. It can be viewed that the ability to control and coordinate hand and finger movements such as (a) copies a simple pattern of different basic shapes (b) draws a human figure without prompts (c) draws a house without prompts using geometric forms, and (d) colors with strokes staying within the lines is average in development among almost all of the pupils. It can be viewed further that the pupils accomplished successfully most of the indicators in the ECD Checklist. Such skills/activities were picking up objects with thumb and index finger, displaying a definite hand preference, putting small objects in/out of containers, holding crayon with all the fingers of his hand making a fist (i.e., palmar grasp), scribbling spontaneously and the like.

On the other hand, Self-help refers to the ability of the child to become independent in performing tasks such as learning to dress oneself, feed oneself, using the toilet, brushing teeth, bathing, tying shoes, and alike (Jacobson, 2011). In terms of the class performance, the kindergarten pupils are average in overall self-help development. This can be interpreted that during the assessment period, most of the indicators such as feeding self with finger food (e.g. biscuits, bread) using fingers, eating without need for spoon feeding during any meal, bathing, drinking from cup without spillage, dressing without assistance except for buttons and tying, going to the designated place to urinate (pee) or move bowels (pooh) and never

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does this in his underpants anymore and the like were accomplished successfully.

Receptive language is the understanding of language "input." This includes the understanding of both words and gestures (North Shore Pediatric Therapy, Nd). Receptive language goes beyond just vocabulary skills, but also the ability to interpret a question as a question, the understanding of concepts like "on" (North Shore Pediatric Therapy). With this, it is shown in table 3 that achievement of the pupils is also average. This can be viewed that the kindergarten pupils performed most of the skills successfully. These were pointing to family member, pointing to 5 body parts, pointing to 5 named pictured objects, following one-step instructions that include simple prepositions (for example, in, on, under, etc.), and following 2-step instructions that include simple prepositions.

Expressive refers to the ability to use words and gestures to express his thoughts and feelings, e.g. draw and tells a story about his drawing (North Shore Pediatric Therapy, Nd). Like the other domains, kindergarten pupils have average performance in expressive language. However, this domain has the greatest number of kindergarten pupils who are under Slight Delay in Overall Development. This can be interpreted that during the last assessment of the checklist, almost 20% of the pupils were not able to perform some of the indicators. Some of these tasks of the pupils were using 5-20 recognizable words, using pronouns (e.g. I, me, ako, akin), naming objects in pictures, asking "who"' and "why" questions, giving account of recent experiences (with prompting) in order of occurrence using past tense and the like.

A child's ability to understand concepts and their logical relations and to manipulate them to arrive at new ideas or conclusions is called Cognitive (Early Childhood Care and Development (ECCD) Council, 2010). In the study, results revealed that kindergarten pupils' ability to look at direction of fallen object, match objects, sort based on shapes, arrange objects according to size from smallest to biggest, name 3 animals or vegetables, assemble simple puzzles and the like is average.

As shown in the Table 3, kindergarten pupils' achievement in socio-emotional domain is also average. This means that majority among the pupils have the ability to know one's self, express and understand feelings, and relate to others. The results further revealed that most of the skills were successfully performed by the kindergarten pupils during the assessment. Some of these skills/activities were playing alone but likes to be near familiar adults or brothers and sisters, demonstrating respect for elders using terms like "po" and "opo, sharing toys with others, identifying feelings in others, helping with family chores (e.g., wiping tables, watering plants, etc.) and other activities prescribed by the checklist. In this regard, teachers, parents

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and other stakeholders must work hand in hand to sustain and even improve the performance of the pupils in this domain. According to Thompson and Lagattuta (2006), socio-emotional development is of importance during the early childhood period because it relates to children's capacities to form relationships, both trusting relationships with adults and friendships with peers and these relationships in turn seem to be related to the speed of learning in early care and educational settings. These markers of positive relations with peers and teachers have implications for children's engagement and participation in the classroom. Children learn to regulate the expression of emotion in a variety of ways, including turning to others with whom they have secure relationships for comfort and support, using external cues, and, increasingly with age, managing their own states of arousal.

Relationship between Kindergarten Pupils' Birth Order and their Achievement in Domains of Early Childhood Development

Birth order is the chronological order of sibling births in a family (Bartleby Research, Nd). First-born, last-born, middle-born and only child were used to describe the birth order of the kindergarten pupils. On the other hand, gross motor, fine motor, self-help, receptive language, expressive language, cognitive and socio-emotional composes the domains early childhood development.

Table 4: Relationship of Kindergarten Pupils' Birth Order and Achievement in Domains of Early Childhood Development

Domain of Early Childhood Development	**p-value**	**Level of Sig.**	**Interpretation**
Gross Motor	0.65	0.05	Not Significant
Fine Motor	0.14	0.05	Not Significant
Self-help	0.26	0.05	Not Significant
Receptive	0.14	0.05	Not Significant
Expressive	0.21	0.05	Not Significant
Cognitive	0.57	0.05	Not Significant
Socio-emotional	0.30	0.05	Not Significant

Using the Chi-square test, statistical results revealed that there is no significant relationship between kindergarten pupils' birth order and achievement in all domains of early childhood development since the computed p-values were more than the level of significance. With this, the performances of the kindergarten pupils in each indicator of each domains of early childhood development are not in relation with their birth orders. This study is a replication of a study conducted by Nanit (2020) in the nearby district of the study's locale – Santa Ignacia North District with 189 kindergarten pupils enrolled in the SY 2015-2016 as respondents. In the previous

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study, the author found that there is a significant relationship of gross motor and expressive domains with the birth order of the kindergarten pupils. With this, we can infer that the findings in two different studies will only be applicable in the location of each study. Thus, a wider scope of study may be done for more conclusive findings.

Difference in Performance of Kindergarten Pupils in terms of their Birth Order

It is part of the objectives of the study to find if there is a significant difference between kindergarten pupils' performance in terms of their birth order using Analysis of Variance as statistical treatment.

Table 5: Difference in Performance of Kindergarten Pupils in terms of their Birth Order

Birth Order	**n**	**Mean**	**Interpretation**
Last-born	61	71.75	A
First-born	74	71.72	A
Middle-born	58	70.16	B
Only child	28	69.86	B

Table 5 shows the result of the conducted test using Analysis of Variance. Based on the statistical results of the study, the computed Least Significant Mean Difference is 1.33. As a rule, if mean difference of two groups is greater than LSMD, the null hypothesis is rejected and vice-versa. Moreover, as an interpretation of the results between each group, if the assigned letter in one group is the same with the other group, the null hypothesis is accepted. Since the computed mean difference of Last-born's and First-born's performance in domains of early childhood development is 0.03, the null hypothesis is accepted. Thus, there is no significant difference between the performance of the last-born and first-born children.

On one hand, since the computed mean difference between last-born and middle is 1.59, the null hypothesis is rejected. There is a significant difference in the performance of the groups; last-born performed better than the middle-born kindergarten pupils. In terms of the performance between last-born and only child pupils, since the computed mean difference is 1.90, the null hypothesis is also rejected. There is a significant difference in the performance of last-born and only child kindergarten pupils. The former performed better than the latter group. Between the first-born and middle-born, their performance is significantly different. This is due to the computed mean difference of 1.56, which is higher than the computed LSMD. First-born children performed better than the middle-born. As a result of statistical analysis, there is a significant difference between the performance of the first-born and only child pupils. The null hypothesis was also rejected due to the

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fact that the mean difference of 1.86 is higher than the computed LSMD of 1.33. Lastly, like the first- and last-born, there is no significant difference between the performance of the middle-born and only child kindergarten pupils. With the mean difference of 0.30, which is lower than the computed LSMD of 1.33, the null hypothesis is accepted. In summary, there is a significant difference in the performance of kindergarten pupils in terms of birth order. However, this is only true between last- and middle-born, last-born, and only child, first- and middle-born, and first-born and only child kindergarten pupils.

Implications of the Study to Preschool Education

In recent decades, numerous studies have shown that early childhood education is key to success in later school and in life. According to Reynolds (2000), long- term effects include a reduction in remediation and assignment to special education, an increase in high school graduation rates, higher rates of employment and lower instances of crime. Furthermore, children who participate in quality early childhood education perform better in school and become productive members of the community and society (UNICEF, Philippines, nd). Thus, all factors including biological factor shall be considered which influence the acquisition of child's holistic development. This study determines the relationship between kindergarten pupils' birth order and achievement in domains of early childhood development at Camiling Central District for the school year 2017-2018 and significant difference of their performance in terms of their birth order.

It can be viewed from the findings that there are still kindergarten pupils who are with slightly significant and significantly delayed. The fact that the pupils were already assessed upon entry to kindergarten and the gathered data is the result of the last assessment of the teacher, there should be a development in the performance of the pupils. It should be noted that all of these domains are crucial in every child's holistic development. Running, jumping, and climbing are just important for a child as learning the ABC's. Each of these domains is also interrelated. When a child starts to give account of recent experiences, he will also be enhancing his cognitive abilities. Learning new words will encourage him to participate more in social situations. Observing children in a few minutes will shed a light on how each domain affects the others.

On the other hand, statistical analysis revealed that domains of early childhood development have no significant relationship with birth order. However, it is interesting to note that there is a significant difference of performance of kindergarten pupils in terms of birth order, particularly, groups between last- and middle-born,

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last-born and only child, first- and middle-born, and first-born and only child kindergarten pupils. With this, since the Kindergarten Education Act supports NAEYCs mission to nurture positive approaches to learning and prepare children to naturally acquire the skills and competencies appropriate for their holistic development, it is the main responsibility of kindergarten teachers to provide learning activities, experiences and/or opportunities to improve their domains in early childhood development considering the birth orders of the kindergarten pupils.

CONCLUSION AND RECOMMENDATIONS

The purpose of this study was to determine the relationship between kindergarten pupils' birth order and achievement in domains of early childhood development at Camiling Central District for the school year 2017-2018 and significant difference of their performance in terms of their birth order. Based on the findings, it is concluded that most of the kindergarten pupils are last-born and first-born, followed by middle-born children, while only few are only-child pupils. On the other hand, there are more female pupils than males. Their performances in domains of early childhood development are all average. In can be concluded that the kindergarten pupils are in normal development in terms of domains of early childhood development.

In addition, there is no significant relationship of kindergarten pupils' birth order and their achievement in domains of early childhood development. Furthermore, there is a significant difference of performance of kindergarten pupils in terms of birth order, particularly, groups between last- and middle-born, last-born and only child, first- and middle-born, and first-born and only child kindergarten pupils. Last-born pupils as the best performers, followed by first- then middle-born; and only-child pupils as least performers based on the computed means. Consequently, the following are hereby recommended:

i. The kindergarten pupils with significantly delayed and/or slightly delayed performance should be improved by providing varied learning experiences catering different developmental domains.
ii. Kindergarten teachers may consider the significant differences in the performance of each birth order in providing activities and/or learning opportunities to kindergarten pupils.
iii. School administrators should provide kindergarten teachers with continual exposure and training to deal with the improvement of kindergarten pupils' achievement in the domains of early childhood development.
iv. Further research has to be conducted considering other localities and variables, as well as wider scope.

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Analysis of Doodles and Listening Comprehension of College Students

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Abstract
Since the discovery that doodling aids to concentration (Andrade, 2009), several studies have been conducted to further ascertain its effects on listening, ranging from its benefits on retrieval strategies, visual recall, learning content from an educational video, among others. While these studies, made excellent follow-ups on Andrade's research, theirs delved mostly on low level comprehension, i.e., recall and recognition. Another attempted to assess the effects of doodling on learning performance. However, it was not specified in their study what particular area of learning was measured. Hence, employing true experimental design particularly the pre-test/post-test control group design, the present study aimed to find the effects of doodling on the listening comprehension of students particularly on literal, interpretative, critical and creative levels. Descriptive and appropriate inferential statistics were used in analyzing the performances of the respondents in the pre-test and post-test, revealing that the students who were exposed to doodling have improved on all levels of listening comprehension and those who were not exposed also improved on literal, interpretative, and creative levels but not in critical. Through the exposure of the students to doodling activities, they produced mainly extraneous doodles or doodles which had no connection with the listening passage, followed by meta-cognitive doodles which reflected that they attempted track their understanding of the passage. The findings of the study further showed that the listening comprehension skills of the students exposed to doodling are significantly higher than those that are not exposed to doodling along literal level. However, no significant differences are found along all other comprehension levels. Finally, the results of the statistical computation showed that the profile of the students (both those who were exposed to doodling and those who were not) were not significantly related to their levels of listening comprehension. It is concluded that doodling can be an aid in improving listening comprehension skills particularly in the literal level but may not contribute much in higher levels. Hence, the researcher recommends the use of doodling as an intervention strategy to aid in improving literal comprehension skills.

Keywords: doodles, doodling, listening, listening comprehension, TOEFL iBT™

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Introduction

Listening is a complex process through which the auditory input undergoes decoding process (Yenkimaleki & Van Heuven, 2016) whereby the auditory stimulus is reconstructed mentally by the receiver (Poelmans, 2003). Such complexity is what caused listening to be seen as a cornerstone competence in language classrooms and more importantly in the workplace (Nair, Li Koo, & Abu Bakar, 2013).

Rivers (1981) as cited by Ghoneim, (2013) added that developing listening skills is important especially that adults spend their time 40% to 50% listening, 25-30% speaking, 11-16% reading, and only about 9% writing. As mentioned by Sadighi and Zare (2006), Nunan (1998) indicated that

> listening is the basic skill in language learning. Without listening skill, learners will never learn to communicate effectively. In fact, over 50% of the time that students spend functioning in a foreign language will be devoted to listening…. (p. 1)

However, listening is a widely neglected skill because of insufficient pedagogical development and teacher training (Mendelsohn, 1998). According to Sadighi and Zare (2006), listening has been a neglected skill in second language acquisition, research, teaching, and assessment for a long time and that the importance of it in the language learning has only been recognized relatively recently. The listening skill has suffered such neglect in the field of research and has not been fully investigated in foreign language acquisition mainly because listening processes are difficult to explore (Chamot, 2005) due to its nature as a covert activity.

Klein (1996) further explained that this neglect resulted largely from two factors. First, listening as well as reading is not a highly visible skill and is not easily assessed, unlike speaking and writing. Thus the sending part of the communication process receives more attention from researchers than the receiving part. Second, very few are willing to improve their listening skills, which suggestively resulted from an incomplete understanding of the process itself. Furthermore, Miller (2009) asserted that comprehending lectures is not a passive listening activity, which means that it requires much effort to master. Because of these limitations, the investigation of the mental operations involved in listening has been difficult and challenging for research.

Despite the abundance of concepts and literature about listening and its importance, past researchers have not been giving ample attention towards listening comprehension, and yet the importance of it in L2 teaching and teaching is highly recognized (Yenkimaleki & Van Heuven, 2016) adding that exposure to the target language and proper training would automatically develop language listening comprehension skills (Clement, 2007). Cross (2009) added that errors in decoding hugely affects the quality of ones understanding of the listening text. Hence, understanding these errors may promote enhanced listening comprehension.

With the recent change in the educational system of the Philippines, the Commission on Higher Education (CHED) issued the memorandum no. 20 s. 2013 stipulating changes on the general education subjects offered in tertiary institutions. One of the objectives of these change was to equip students with intellectual competencies possessing "higher levels of comprehension." Furthermore, the new subject *Purposive Communication* aimed to enhance students' five major skills (listening, writing, reading, speaking and viewing) so that at the end of the course, the "students should be able to listen, comprehend, critique, and respond to live or recorded

conversations…" Hence with the new curriculum, new and more advanced strategies to strengthen students' skills are also expected to be introduced.

As such, different strategies have been utilized to measure the performances of different respondents in various listening comprehension researches. Yenkimaleki and Van Heuven (2016) experimented on the effects of explicit teaching of prosodic features on the development of listening comprehension. Specifically, the study answered the question of whether the awareness training of prosodic features would lead to developing the global listening comprehension in message perception for student interpreter trainees. As resulted from the study, awareness training of prosodic feature contributed to the development of the listening comprehension of interpreter trainees.

Moreover, Hemmati and Ghaderi (2014) delved away from the listeners perspective but on the given questions and analyzed whether these could contribute to the development of listening comprehension. Thus they experimented on the effects of four formats of multiple-choice questions (MCQs) on the listening comprehension of EFL learners. The study implied that to measure the listening comprehension of learners, test questions must be properly constructed regardless of the format used adding that full question preview format, answer option preview format, and question preview format could have a facilitative effect on the listening comprehension.

Similarly, the study Gowhary, Pourhalashi, Jamalinesari, and Azizifar (2015) suggested that using captions had a significant effect to the students' listening comprehension concluding that captioning videos could be helpful in overcoming their listening difficulties. Similarly, Amaluddin, Salasiah and Mardiah (2018) indicated the use of audio-visual aids through the use of metacognitive strategies can significangly improve the students' listening comprehension. Paguirigan (2010) conducted a study, a rather different approach, on the effects of background music on the listening comprehension of selected pupils. Surprisingly, the study found out that the listening comprehension of those who had background music is much higher compared to those had not.

Despite the complexity of studying listening and listening comprehension, Gloria's (1996) study as affirmed by the more recent studies of Carrell et al., (2004), Lin (2006), and Amini Asl and Khierzadeh (2016) revealed another way to improve listening study skill was to employ note-taking, an act that resembled some of its characteristics with doodling particularly in scribbling, only that in note-taking, one writes important words.

Since the discovery of Andrade (2009) that doodling aids concentration, several researchers have embarked on conducting more studies about and begun discovering other benefits of doodling (Aellig et al., 2009; Chan, 2012; Qutub, 2013; Singh & Kashyap, 2014; Tadayon & Afhami, 2016; and Boggs et al., 2017). Quite impressive, these researches have taken extra efforts to prove their hypotheses.

Singh and Kashyap (2014) examined the benefits of doodling on retrieval strategies, i.e., recall and recognition. The results indicated that recall fell under the favor of recognition in retrieving memory. The study suggested that recall was harder than recognition because of the extensive effort in remembering the learning event. Moreover, the results pointed out that doodling percentage did not affect the retrieval efficiency rather it was doodling itself which provided benefits for memory retrieval. Contrary to previous discoveries, however, the study of Chan (2012) indicated that although doodling served as a tool to aid in concentration as well as auditory recall,

it did not elicit positive effects on visual recall. The study explained further that such negative effect was

because the doodlers struggled in having divided visual processing resources implying that when multitasking is engaged in similar primary modality, negative effects could occur in the amount of information processed and retained.

Boggs et al. (2017) affirmed the results of Chan's (2012) study having found out that doodling was not advantageous in increasing recall performance despite the avoidance of daydreaming. This, however, is explained by the variables in the study, where they classified the doodlers under different conditions: structured doodling for those who shaded shapes and unstructured doodling for those who were free to draw anything on their empty papers. Surprisingly, those under the structured doodling had significantly higher scores than those under the unstructured doodling. This was due to extensive mental processes they had to undergo, i.e., deciding what to doodle, reproducing the mental image to the paper and simultaneously attending to the audio recording. Furthermore, Aellig et al., (2009) explored the relationship of attention span and doodling with the ability to learn content from an educational video. Their study suggested that free doodling and the ability to learn contents from an educational video had no significant relationship.

Despite these negativities discussed and effected from these researches, more studies believe that doodling proved to be beneficial. Wammes et al. (2016) pointed out that drawing as an aid to remembering could have a significant effect on the improvement of memory. Moreover, Tadayon and Afhami (2016) assessed the effects of doodling on the learning performance of high school students. With the employment of pre-test and post-test, their study found out that those who doodled outperformed those who did not. Such a result draws the implication that doodling is, in fact, beneficial particularly in learning.

Much of these studies about doodling covered only the effects of it on the recall, a lower order thinking skill and learning, a very broad concept. The study of Andrade (2009) regarding the effect of doodling on the concentration of the respondents, where she found out that doodling was indeed effective in aiding to concentration, only discusses the first level of cognition, i.e., remembering. If one wants to utilize one's cognition fully, higher levels must be covered. This, however, reflects how difficult it would be to measure listening.

While several strategies have been devised and experimented on to aid listening comprehension, the relationship between doodling – one that has received attention to many researchers in cognitive psychology – and listening comprehension has not been explored yet in the world of research. What is missing in the above mentioned studies, however, is their consideration on the doodles of their respondents. The discussion of results purely concentrated on the act of doodling and its effects to the performances of the respondents but none of those studies presented the doodles and analyzed whether they may have helped or not.

On the search for doodle classification, most literatures only focused on the psychological meanings and classifications of doodles. But recent studies have been conducted to describe the doodles of students and their possible effects to their performances (De Leon et al., 2019; McCartney et al., 2005; & Lister et al. 2004).

Although, these studies were conducted among programming students and the doodles which they classified were highly related to programming, the classifications that they were able to generate could also be applied to the other fields that employs doodling on tests and activities.

Lister et al. (2004) in particular was the first to categorize doodles based on their students' annotations of the tests. It was found out that if a student carefully traces through the code, the likelihood of getting the correct answer is high. In contrast, not doodling only leads to the correct answer 50% of the time.

Moreover, MacCartney et al. (2005) conducted another study and utilized the categories developed by Lister et al. However, in the analysis of their results, several issues surfaced in relation to the questions and the doodles of the students. Hence to resolve the issue, four disjoint categories, reclassifying each question, were created: *Blank, Some Tracing, Elimination, or Others*. Such categories were based on their observation that that tracing and process of elimination are recognizable strategies, and, with Blank, cover 89% of the observations. They then found out that the most effective strategy is tracing and elimination which includes *alternate answer* and *ruled out.*

From the studies presented above, the study of De Leon et al. (2019) may have provided a better way of facilitating the analysis of multiple types of doodles. Although their groupings are loosely based from McCartney et al. (2004) and are applied to programming tests, the definitions they provided possess applicability in the present study. Since the respondents of the said studies were programming students, many of the generated categories of doodles may not apply to the respondents of the present study, especially, that the present study focuses on communication major students. But the classifications of De Leon et al. provides better perspective on analyzing the doodles of the students. The generality of the definitions have also paved inclusion of doodles that are produced in tests whether they be programming or not. Hence the present study adapted these classifications in the analysis of doodles of the respondents. The figure below presents these new categories and their descriptions.

Name	Description
Clarifications	Consisted of all corrections or additional instructions from the teacher.
Meta-cognitive processes	Doodles that imply that students are tracking their own learning or progress.
Trace	The Trace category was comprised of Computation, Practice Code, Number, Synchronized Trace, Odd Trace, and Trace.
Extraneous Marks	Markings that appear meaningless or irrelevant to the activity.

Figure 1. Categorization of doodles as developed by De Leon et al. (2019)

From these categories, they found out that those who doodled (37%) scored between 91 and 100 out of a possible 100. From the majority (62%) who did opt to doodle, only 15% of them had similar scores with those who doodled, and the rest scored less than 90. They then concluded that not doodling at all does not necessarily mean a student is not doing well since there were those who did not doodle but managed to get high or similar scores to those who doodled. This may also mean that might already have a good understanding of the exercises given them and that they have

no need for the extra mental aids.

Grounded on the above studies, the study attempted to venture on a more in-depth analysis of the effects of doodling on the listening comprehension of students. Furthermore, the study considered the act of doodling, the doodles produced and the listening activities in the analysis of the results as well as in the discussion of the causes that might have assisted in the improvement of students' listening comprehension. Hence, the study also adapted several variables from these mentioned studies to further provide knowledge to the world as to why many researchers believe that doodling improves listening as well as to identify what particular level of comprehension doodling could be helpful.

Statement of the Problem

Generally, the study was conducted to determine the effects of doodling on the listening comprehension of college students.

Specifically, it sought to answer the following problems:

1. What is the profile of the respondents in terms of:
   a. sex;
   b. age;
   c. first language;
   d. verbal reasoning score in the entrance examination;
   e. learning styles?
2. What is the listening comprehension level of the college students exposed to doodling activities and those not exposed to doodling activities both in their pre-test and post-test in the following:
   a. literal;
   b. interpretative;
   c. critical, and
   d. creative?
3. What are the types of doodles produced by the students while listening to recorded conversations and lectures?
4. Is there a significant difference between the pre-test and post-test mean scores of the students exposed to doodling?
5. Is there a significant difference between the pre-test and post-test mean scores of the students who are not exposed to doodling?
6. Is there a significant difference between the level of listening comprehension of the college students exposed to doodling and those that are not?
7. Is there a significant relationship between the profile variables and the level of listening comprehension of the college students not exposed to doodling and those that are exposed to doodling activities?

Null Hypotheses

The following hypotheses were tested at 0.05 level of significance:

1. There is no significant difference between the pretest and posttest mean scores of the students exposed to doodling.

2. There is no significant difference between the pretest and posttest mean scores of the students who are not exposed to doodling.

3. There is no significant difference between the level of listening comprehension of the college students exposed to doodling and those that are not.

4. There is no significant relationship between the profile variables and the level of listening comprehension of the college students not exposed to doodling and those that are exposed to doodling activities

Methodology

Research Design

The study utilized a true experimental design particularly the Pretest-Posttest Control Group Design because of three (3) factors that were duly considered: Randomization, Treatment, and Control. Firstly, in randomization, all participants were given an equal chance of being assigned into any group in the experiment. This also entails that the randomization process should result to equivalence between the two groups. Since the aim is to observe the effect of doodling on the listening comprehension of the students, this study involved two groups: those that were exposed to doodling (experimental group) and those that were not (control group). Secondly, a treatment was applied to the experimental group. Instead of listening only to the recordings, the experimental group doodled as they listen. Finally, control was used to avoid external influences on the outcome of the study. Thus, the experiment was conducted with both of the groups listening to the same recorded lectures and conversations at the same time, only that the experimental group performed an added task. The conduct of the experiment was done as illustrated in the following diagram:

Students exposed to doodling	O1	X	O2
Students not exposed to doodling	O1		O2

As shown in the diagram, the participants were grouped accordingly and are separated by the solid line. This solid line represents randomization, thus, the participants in both groups were subjected to random assignment. Moreover, as can be gleaned from the diagram, the initial measurements of the dependent variable or the pre-tests for both groups were administered at the same time. O1 symbolizes the performance of the respective groups in the pre-test. Whereas, the X denotes doodling as the treatment in the study. Finally, O2 represents the final measurement of the dependent variable which is the performance of the participants in both groups in the post-test.

Participants

The respondents of the study comprised of 38 Bachelor of Science in Development Communication students from the Tarlac Agricultural University in the second semester of academic year 2018-2019. This number of students is the total population of those that take communication and language courses in the said university. Randomization was employed to give each student an equal chance of being assigned to any of the groups.

Prior to conducting the experiment, the researcher determined first the profile of the respondents. And from that profile, the researcher utilized their final grade in the subject Purposive Communication which they have taken in the previous semester as the identifier for the randomization. The participants were sorted according to their grades from highest to lowest. Those, whose ranks were odd number, were assigned to the experimental group and those, whose

ranks were even number, were also assigned to the control group. This was done to ensure that each group would have an equal number of participants and also homogeneous performances. Hence, the groups had 19 participants each.

Data Gathering Instruments

Survey Questionnaire was used to gather the profile of the respondents in terms of sex, age, first language, verbal reasoning score in the entrance examination and final grade in Purposive Communication including the **Memletics Learning Styles Questionnaire** to identify the participants' preferred learning styles. The reliability test result of this instrument using Cronbach's alpha is 0.81 (Moenikia & Zahed-Babelan, 2010), suggesting that the internal consistency or reliability of the questionnaire is high. To get the participants' initial and final listening comprehension scores, the researcher utilized the listening comprehension questions adapted from **TOEFL iBT™**. The listening section of the TOEFL iBT test measures students' ability to understand conversations and lectures in English. The questions focus on identifying the main idea and supporting details, recognizing the speaker's attitude and purpose, and making inferences. Permissions from Educational Testing Services (ETS), the developer of TOEFL iBT™, to use the tests in this study have been duly acquired.

Data Gathering Procedure

The respondents were given the survey questionnaires and Memletic® Learning Styles Inventory to get their profile and learning styles. The data gathered for the profile of the respondents, particularly their grade in Purposive Communication were used as the basis for the randomization.

Upon the assignment of participants in the control and experimental groups through randomization, the researcher then commenced on the conduct of the experiment. The date and time of the experiment are the same to prevent the time element to impose influence on the outcome of the study.

The pre-test was first administered to assess the initial listening comprehension abilities of the students. Then, for three weeks, the respondents were asked to listen to different recordings, one recording per session. The activities were conducted twice a week, thus six (6) sessions for three weeks. The control group was asked to listen to the recording and do nothing else; while the experimental group was given blank sheets of paper and pencils. They were instructed that they can use the pen and paper should they feel bored. At the end of each session, comprehension questions was administered to the participants.

At the conclusion of the experiment, the researcher administered the post-test among the participants. The post-test was just the same with the pre-test, but the order of the items was disarranged. Finally, the doodles of the respondents were gathered and analyzed carefully to determine their classification and to ascertain how these doodles may have affected their performances in the listening activities.

Statistical Treatment

To answer the underlying problems posed by the study, fundamental statistical operations were utilized. Problem 1 sought to determine the profile of the respondents, hence, frequency counts and percentages were utilized. Problem 2 looked for the types of doodles which the students produced while listening to recorded conversations and lectures, hence, to facilitate analysis of the

doodles, the researcher adapted the taxonomy of De Leon (2019) to classify the doodles and utilized frequency counts and percentages to assist in the discussion. For Problem 3, the levels of the listening comprehension of the students were determined based on the levels of comprehension taxonomy developed by Al-Musalli (2001). Per level of comprehension, i.e. literal, interpretative, critical and creative, the researcher tallied the scores of the participants and computed their mean. Then, the percentage of the mean score for that particular level was computed against the total number of items classified under that level of comprehension. To answer problems 4 and 5, paired t-test was used to compute for any significant differences between the pretest and posttest mean scores of the students exposed to doodling and those that are not. For problem 6, independent sample t-test was used to compute for any significant differences between the levels of comprehension of the students exposed to doodling and those that are not. And for Problem 7, Pearson Product Moment Correlation Coefficient were used to determine the correlation between level of listening comprehension and the profile variables Age and Language ability score in the entrance examination; Point-biserial for Sex; and Contingency Co-efficient for First Language variable.

Results And Discussion

On the Profile of the Respondents

Table 1. Profile of the Respondents

Profile Variable	Category	College Students Not Exposed to Doodling Activities n=19		College Students Exposed to Doodling Activities n=19	
		F	Percent (%)	f	Percent (%)
Sex	Male	5	26.3	4	21.1
	Female	**14**	**73.7**	**15**	**78.9**
Age	20 years old and below	**16**	**84.2**	**14**	**73.7**
	21-30 years old	1	5.3	4	21.1
	31 and above	2	10.6	1	5.3
First Language	Ilocano	5	26.3	3	15.8
	Kapampangan	1	5.3	1	5.3
	Pangasinan	1	5.3	-	-
	Filipino	**12**	**63.2**	**15**	**78.9**
	English	-	-	-	-
Verbal Reasoning Score	Below 70	-	-	2	10.6
	71-79	1	5.3	1	5.3
	80-89	**18**	**94.7**	**15**	**78.9**
	90-95	-	-	-	5.3
	96-100	-	-	-	-
Learning styles	Visual	2	10.52	2	10.52
	Aural	2	10.52	2	10.52
	Verbal	4	21.05	5	26.31
	Physical	5	26.31	4	21.05
	Logical	1	5.26	0	0
	Social	**7**	**36.84**	6	31.58
	Solitary	6	31.58	**7**	**36.84**

Sex. Table 1 shows that the participants were equally distributed to both groups with 19 individuals each. From the students who were not exposed to doodling, 14 or 73.5% are females and 5 or 26.3% are males. While the students who were exposed to doodling were composed of 15 or 78.9% females and 4 or 21.1% males. These data only shows that the development communication program of Tarlac Agricultural University is dominated by females.

Age. In can be gleaned in table 1 that majority of the participants in both groups are 20 years old and below with 16 or 84.2% students not exposed to doodling and 15 or 78.9% exposed to

doodling. This distribution may mean that the respondents are mostly fresh graduates from high school. However, it is also noticeable that there are those whose ages do not align with the expected age for college students. Based on the interview made by the researcher, some of these students have stopped after graduating from high school and some have started college educations but, due to financial insufficiency, have stopped for some time and now are returning.

First Language (L1). The data on table 1 reveals that the majority of the participants in both groups have learned Filipino language before learning any other languages with the distribution of 12 or 63.2% for those that are not exposed to doodling and 15 or 78.9% from those that were exposed, followed by Ilocano with 5 or 26.3% and 15 or 789% from the students that were not exposed to doodling and those that were exposed, respectively. None of the respondents has the English language as their L1.

Verbal Reasoning Score. Table 1 also shows that majority of the respondents have scores ranging from 80-89 with the distribution of 18 or 94.7% from the students who were not exposed to doodling and 15 or 78.9% from the student who were exposed. This means that the students have above average verbal reasoning abilities. According to Adeyemi (2017), verbal reasoning involves making meaning based on the information given, going beyond that information to better understanding and applying verbal skills to new learning. Hence, this result of the study means that the respondents are generally aligned to the program they enrolled in because of their scores in the verbal reasoning test. Development Communication program requires that students must have good communication skills, chiefly because this program would lead them to public and even mass communication. Hence, higher language ability is an advantage. Furthermore, Adeyemi concluded in his study that there is a significant relationship between students' knowledge of verbal reasoning and performance, which means that the deeper knowledge a student has of verbal reasoning, the higher achievement he would accomplish.

Learning Styles. As shown in table 1, majority of the students that were not exposed to doodling are social learners which means that they prefer to learn in groups or with other people. On the other hand, majority of the students who were exposed to doodling are solitary which means that they prefer to work alone or use self-study. The Logical Learning style has the least possessor (one or 3.70%) which means that only one prefers the use of logic, reasoning, and systems in learning. This result means that the development communication students have multiple learning preferences as they acquire knowledge.

This particular result of the study affirms the study of Moenikia and Zahed-Babelan (2010) saying that those students with social learning styles have suitable performance in language learning. Moreover, Banner and Rayner (2000) mentioned that successful people with social personalities are more communicative and better learners of new words. Thus, based on these mentioned studies and the results of the present study, the learning styles that are possessed by the Development Communication students suit what the course commonly necessitates, that is, working with people and communicating with them.

On the Listening Comprehension Levels Of The Students Exposed To Doodling And Those That Are Not Both In Their Pre-Test And Post-Test

Literal. Table 2 presents the listening comprehension levels of the students exposed to doodling activities and those that were not both in their pre-test and post-test performances along

literal level. It can be gleaned from the table that majority (52.6%) of the students who were not exposed to doodling had "low" levels in literal comprehension as resulted from the pre-test. Similarly, majority (47.4%) of those that were exposed to doodling had "low" levels in literal comprehension before the conduct of the experiment.

Table 2. Listening Comprehension Level of the College Students Not Exposed to Doodling and Students Exposed to Doodling Activities both in their Pre-test and Post-test along Literal Level

Comprehension Level	Skill Level	College Students Not Exposed to Doodling		College Students Exposed to Doodling	
		Pre-test	**Post-test**	**Pre-test**	**Post-test**
		Percent (%)	Percent (%)	Percent (%)	Percent (%)
Literal	Very High	-	10.5	-	5.3
	High	5.3	-	10.5	10.5
	Average	31.6	**31.6**	36.8	**63.2**
	Low	**52.6**	**31.6**	**47.4**	21.1
	Very Low	10.5	26.3	5.3	-
	Mean Score (DE)	**5.95 (Low)**	**5.95 (Low)**	**6.32 (Average)**	**7.84 (Average)**

DE-descriptive equivalent

In totality, however, the pre-test mean score (5.95) of the students that were not exposed to doodling falls under low level while the mean score of those that were exposed to doodling falls under average level along literal comprehension. This indicates that, in both groups, the majority were slightly proficient in recognizing or recalling of main ideas, details, sequences, and comprehending the gist of what is said.

The table also reveals that, at the conclusion of the experiment, the students that were not exposed to doodling had two (2) majorities (31.6%): those at average level and those at low level. It can be noticed that the number of respondents who had average level in the pre-test is the same with those in the post-test which means that the number of those who were previously average did not improve at all. Whilst the number of those who possessed low levels at the pre-test, which previously was the majority (52.6%), decreased to just 31.6%. This decrease could have been attributed positively but considering the increase in the number of students possessing very low levels from 10.5% to 26.3%, this may indicate that there was not much of improvement at all. This is backed up by the mean score 5.95, which means that that although there were changes in the distribution of levels, in totality, the group mean score did not change, hence, their levels did not improve.

For the students who were exposed to doodling activities, the table reveals that their exposure may have affected their performance positively, in which they performed better in their post-test than in their pre-test. This result can be seen via the increase in the number of respondents with improved comprehension levels. Previously, the majority possessed "low" levels of literal comprehension skills, but after the exposure to doodling, majority of them incurred higher level of

comprehension skill, thus, earning "average" level. This means that they have improved their skills in literal comprehension and from slightly proficient, they became fairly proficient.

This particular result of the study is supported by Andrade (2009) who pioneered the study on doodling and listening. In her study, two groups were also utilized in a single session experiment with one group allowed to doodle while listening and the other deprived of any tasks while listening. After five minutes, the participant were asked to write names and places that they could remember especially those that were attending the party. Results show that those who doodled remembered 29% more than those who did not. She then concluded that the experiment resulted to positive effects on the exposed because through doodling the participants may have been kept awake, thus forcing them to utilize executive resources and that doodling may have reduced daydreaming. Literal comprehension as defined in the present study covered much on remembering details, thus, the results in the study of Andrade (2009) are affirmed by the present.

Furthermore, this particular result of the study also agrees with the study of Wammes et al. (2016) who found out that drawing improves memory by encouraging a seamless integration of semantic, visual, and motor aspects of a memory trace. Hence, the doodles which the students produced during the experiment may also be considered as a factor in improving their memory since in those activities, the participants may have adapted in using their schemata (Zeng, 2007) and connecting it with the listening passage, thus producing an image that reflects their learning.

By performing this process over a period of time, the students seemed to have trained themselves to remember details with such strategy. This particular result occurred because doodling may have maintained arousal while consuming a limited amount of available cognitive resources as opposed to daydreaming, which consumes a high amount of cognitive resources (Boggs, Cohen, & Marchand, 2017).

Interpretative. As shown in table 3, majority or 57.9% of the students who were not exposed to doodling had "very low" levels in interpretative comprehension as resulted from the pre-test. While of those who were exposed to doodling, majority or 47.4% had "low" levels. Hence, prior to the conduct of the experiment the students exposed to doodling activities had higher levels of interpretative comprehension than those who were not. In totality, however, the mean scores of both groups say otherwise as both groups incurred respective means scores that fall under low level: 2.31 for the students that were not exposed to doodling and 2. 68 for those that were exposed.

This means that in terms of interpretative comprehension skills, the students in the control group or those that were not exposed to doodling were not proficient in inferring information from the speaker or the social setting, while the students who were exposed were a step higher, which is slightly proficient.

Table 3. Listening Comprehension Level of the College Students Not Exposed to Doodling and Students Exposed to Doodling Activities both in their Pre-test and Post-test along Interpretative Level

Comprehension Level	Skill Level	College Students Not Exposed to Doodling		College Students Exposed to Doodling	
		Pre-test	**Post-test**	**Pre-test**	**Post-test**
		Percent (%)	Percent (%)	Percent (%)	Percent (%)
Interpretative	Very High	-	-	-	-
	High	-	10.5	-	21.1
	Average	-	10.5	10.5	**36.8**
	Low	42.1	**47.4**	**47.4**	21.1
	Very Low	**57.9**	31.6	42.1	21.1
	Mean Score (DE)	**2.31 (Low)**	**3.37 (Low)**	**2.68 (Low)**	**4.58 (Average)**

DE-descriptive equivalent

It can also be seen on the table that both groups have made improvements on this particular levels of comprehension as reflected on their post-test performances. Among the students who were not exposed to doodling, the majority (47.4%) now have low levels, while among the students who were exposed to doodling, the majority (36.8%) possess average levels. In totality, the mean scores of both groups showed a difference of improvements as seen in their new levels. The students that were not exposed to doodling scored an average of 3.37, which falls under low level while those that were exposed scored an average of 4.58, which falls under average level.

It can be inferred from this data that doodling may have been assistive among those who were exposed to doodling as doing so did not distract them in inferring information from the passage. But in contrast, as reflected from improvement of the levels of those that were not exposed, doodling may also not have contributed much since the levels of those that were not exposed have also improved. Additionally, had the students exposed to doodling improved by surpassing two or more levels, it would have been possible to conclude that doodling was more effective than non-doodling, but this is not the case as both groups stepped up with just one level only. And although both groups have improved, the level of the students who were exposed to doodling is still higher. This is also supported by the mean score of both groups

Few possible reasons may be attributed to this specific result of the study. First, the high percentage of extraneous doodles produced by the students during the experiment may have caused the lack of effectiveness of their inferring skills. Although it was observable that the students exerted efforts on producing meta-cognitive doodles, which would have been helpful to them if properly executed and substantially surpassing the extraneous ones, their exposure may not have sufficiently helped them improve or their doodles may have not represented the information from the listening passage that can only be understood when inferred. Second, Andrade (2009), in the same study where she asserted that doodling aids to concentration, noted that "tests of memory or

attention often use a second task to selectively block a particular mental process, and if that process happened to be important for the main cognitive task, it would result in performance being impaired due to this competition for cognitive resources". Hence, in this study, the respondents may have had a hard time choosing which to focus on because of competing modalities and that one particular mental process may have been blocked.

Critical. As shown in table 4, majority of the students who were exposed and those that were not exposed to doodling activities had "very low" levels in critical comprehension before the conduct of the experiment (52.6% and 63.2%, respectively). This means that prior to the conduct of the experiment, majority in both groups were not proficient in critical comprehension or, more specifically, in making assumptions, conclusions, and even evaluation. However, when computed in totality, both groups had mean scores of that fall under low level (1.11 for those that were not exposed and 1.42 for those that were exposed to doodling). Hence, when described in totality, both groups are slightly proficient.

Table 4. Listening Comprehension Level of the College Students Not Exposed to Doodling and Students Exposed to Doodling Activities both in their Pre-test and Post-test along Critical Level

Comprehension Level	Skill Level	College Students Not Exposed to Doodling		College Students Exposed to Doodling	
		Pre-test	**Post-test**	**Pre-test**	**Post-test**
		Percent (%)	Percent (%)	Percent (%)	Percent (%)
Critical	Very High	-	-	-	10.5
	High	-	10.5	-	5.3
	Average	5.3	15.8	10.5	21.1
	Low	31.6	15.8	36.8	**31.6**
	Very Low	**63.2**	**57.9**	**52.6**	**31.6**
	Mean Score (DE)	**1.11 (Low)**	**1.53 (Low)**	**1.42 (Low)**	**2.21 (Average)**

DE-descriptive equivalent

It can also be observed that both groups have somehow improved on their comprehension skills as shown by the decrease in the percentage of those that had very low levels in the post-test and the increase in the percentages of higher levels. However, for the students that were not exposed to doodling, the decline in the percentage of participants with very low levels may not have contributed much to the improvement of the whole group's performance as the majority still possessed very low level of critical comprehension skills after taking the post-test. The whole group's mean score (1.53) also did not show much of improvements as the level is still low.

Furthermore, majority of the students that were exposed to doodling previously possessed "very low" level of critical comprehension (52.6%) but after the exposure, the group performed better in the post-test. As presented, their post-test scores indicate that there are new two (2) majorities, both with 31.6% in low and very low levels. Thus, this result suggests that they became

"slightly proficient' in critical comprehension or making appropriate judgments about the message of speaker's personality, making assumptions, drawing conclusions, making evaluation. In totality, the groups mean score (2.21) also indicate an improvement as it falls under average level.

This result of the study is supported by Tadayon and Afhami (2016) in terms of the effect of artistic activities. As cited in their study, artistic activities can lead to academic achievement (Eisner, 1998). Further, in terms of educational performance, effective function of working memory is a vital element wherein when the working memory is active, concentration is also active. Hence as resulted in their study and in the present study, artistic activities (such as doodling in this study) may have improved learning and comprehension by improving working memory and concentration.

Moreover, Andrade (2009) asserted that doodling aids to concentration, hence, through doodling, the concentration of the students was improved and they were able to critically listen to recorded conversations and lectures in the tests as well as during the experiment.

Creative. As shown in table 5, majority the students exposed to doodling (47.4%) and also majority of those that were not (42.1%) possessed very low levels of creative comprehension. This means initially they were not proficient in handling verbal and non-verbal communicative strategies, identifying hesitation and making appropriate responses. In totality, the pre-test mean scores of the students not exposed to doodling (.95) fall under low level and the pre-test mean scores of students exposed to doodling (.74) fall under very low level.

Table 5. Listening Comprehension Level of the College Students Not Exposed to Doodling and Students Exposed to Doodling Activities both in their Pre-test and Post-test along Creative Level

Comprehension Level	Skill Level	College Students Not Exposed to Doodling		College Students Exposed to Doodling	
		Pre-test	**Post-test**	**Pre-test**	**Post-test**
		Percent (%)	Percent (%)	Percent (%)	Percent (%)
Creative	Very High	-	5.3	-	10.5
	High	5.3	26.3	-	21.1
	Average	26.3	**31.6**	21.1	21.1
	Low	26.3	10.5	31.6	**31.6**
	Very Low	**42.1**	26.3	**47.4**	15.8
	Mean Score (DE)	**.95 (Low)**	**1.74 (Average)**	**.74 (Very Low)**	**1.79 (Average)**

DE-descriptive equivalent

Moreover, the conduct of the experiment may have facilitated improvement of listening comprehension skills among all the participants of this study as shown by the increase in the number of students possessing higher levels. For example, for the students who were not exposed to doodling, majority possessed very low levels as reflected from their pre-test performances but after the experiment, their post-test performances reveal that the majority has earned average

levels. Hence, despite being deprived of any treatments, the group still managed to improve their creative comprehension skills. This is also attested by their post-test mean score (1.74) which fall under average.

Similarly, those students that were exposed to doodling improved on their creative listening comprehension skills. It can be noticed from the table that in the pre-test, nobody in the group possessed high and very high levels and the majority rested at very low but after being exposed to doodling, 10.5% had very high and 21.1% had high levels and the majority possessed low levels as reflected in their post-test performances. In totality, the group performance also improved as their post-test mean score resulted to 1.79 which fall under average, a level higher than their pre-test performance.

This particular result of the study affirms the claim of Tadayon and Afhami (2016) that doodling improves learning. This means that with the aid of doodling, the students, who were exposed to doing it, were able to improve their learning, specifically, in terms of listening comprehension. Furthermore, this particular result of the study is supported by the study of Wammes et al. (2016) which concluded that drawing improves memory by encouraging a seamless integration of semantic, visual, and motor aspects of a memory trace. The respondents did not only improve in remembering details but in the higher levels as well. Hence, from this particular result of the study, doodling is beneficial to students.

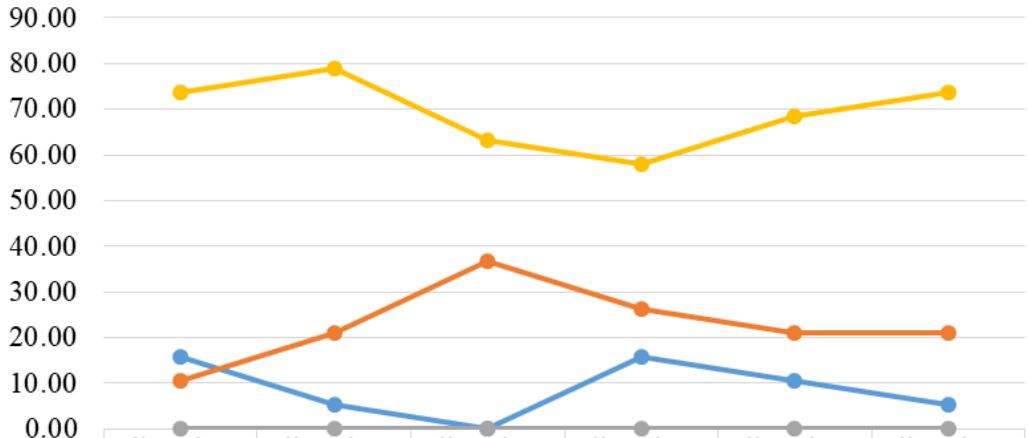
The preceding results revealed that the students of both conditions made improvements on specific levels of listening comprehension. Additionally, the statistical analysis presented in the following sections were purposefully conducted to ensure the validity of the results. Furthermore, the following sections also aimed at examining further the extent of the effect of doodling on specific levels of listening comprehension as well as to provide answers on whether doodling can be accepted as an aid to improving listening comprehension or not.

On the Types of Doodles Produced by the Students Exposed to Doodling Activities

Doodles are commonly defined as aimless scribbles to relieve boredom but this study adapted the definition of Brown (2010) which described doodles as "markings [that] help a person think." Hence, this section presents how the doodles of the students helped them understand the listening passage. This section also includes the analysis of the doodles produced by the students exposed to doodling activities during the experiment. For six (6) meetings, the students were given pieces of empty letter size papers where they asked to doodle as they listened to the recordings. The doodles were then collected and subjected to analysis. Doodles in this study are classified based on the taxonomy of De Leon et al. (2019), which as stated, leads towards finding the relationship of doodles and the achievement of students.

Since the TOEFL iBT™ was designed mainly for college students, ETS covered various disciplines in their listening comprehension tests. As surfaced on the analysis, the respondents made various doodles, some of which are related to the passage, some are about the subject which they are attending, and some are far from the topic.

attending, and some are far from the topic.



	listening activity 1	listening activity 2	listening activity 3	listening activity 4	listening activity 5	listening activity 6
clarification	15.79	5.26	0.00	15.79	10.53	5.26
meta-cognitive	10.53	21.05	36.84	26.32	21.05	21.05
trace	0.00	0.00	0.00	0.00	0.00	0.00
extraneous	73.68	78.95	63.16	57.89	68.42	73.68

Figure 6. Percentage trend of the types of doodle produced by the students across six (6) listening activities.

From the percentages of the types of doodles produced by the respondents, Figure 6 presents a clear picture of the progress of the respondents across all six listening activities. It is visible in the figure that the extraneous types of doodles are those that have prevailed among the doodles of the respondents throughout the experiment. It can also be gleaned from the table that, at the beginning of the experiment, the number of extraneous doodles are distant from the all other types. Although extraneous types of doodles were never surpassed by the other types, it is also evident that there is improvement in other types, particularly clarification and meta-cognitive. For example, in listening activity 1, the respondents needed clarifications first before using meta-cognition. However, starting from activity 2 onwards, the respondents have produced more meta-cognitive types than clarification. This may have happened due to the similarities of the activities. The first three activities were recorded lectures whilst the remaining three activities were conversations. Hence, this explains the ascent of meta-cognitive types of doodles that the respondents produced because, in those activities, the students may have found their way of doodling and understanding a recorded lecture simultaneously. Another is that the students may have already realized the role of their doodles in their comprehension. This particular result of the study may also imply that the students are tracking their learning and aware of understanding the recordings.

Moreover, the figure shows that when the type of recording was changed, i.e. the recorded lectures which were used previously were changed to conversation, the number of clarification types increased while the number of meta-cognitive types decreased. This may imply that the students may be surprised with the change hence their doodles of meta-cognitive types declined

and they needed more effort for clarifications. Furthermore, upon adjustment with the new type of activity, they may have found their way in combining multiple modalities.

This result of the study agrees with Brown (2010) that in order for information to be truly integrated, at least two of the major modalities must be integrated or one modality must be incorporated with a strong emotional experience. Moreover, Petrovsky (2009, cited by Qutub, 2012) added that visual symbols can replace speech as indirect forms of conscious expression, where in this study, the doodles of the students are representative of their understanding since they would not want to speak while trying to understand a listening passage.

On the Difference between the Pre-Test and Post-Test Mean Scores of the Students Exposed to Doodling

Table 12 presents the differences between the pre-test and post-test mean scores of the students exposed to doodling along the different listening comprehension levels. The statistical computation reveals that all listening comprehension levels of the students exposed to doodling based on their t – computed values (literal with -3.683; interpretative with -3.473; critical with -2.395; and creative with -4.472) had associated significant values (literal with .002; interpretative with .003; critical with; & creative with .000) lower than the 0.05 level of significance. Hence, for all levels, the null hypothesis is rejected. This means that there is a significant difference between pre-test and post-test mean scores of the students exposed to doodling along all comprehension levels. Moreover, the data shows that along literal, interpretative and creative level, the difference is highly significant at .01 significance value.

According to Smallwood et al. (2007), as cited by Andrade (2009), doodling made a positive effect to the listener's recall ability, implying it may have facilitated in reducing daydreaming because another undemanding task has been employed. Hence, their study supports the results of the present study that doodling could be an aid to listening. In the case of the present study, doodling is also beneficial as it aided in improving the listening comprehension of the students. As shown in table 12, the comprehension levels of the students who were exposed to doodling increased.

Table 12. Difference between the Pre-test and Post-test Mean Scores of the Students Exposed to Doodling

Comprehension Level along:	Score	Mean	Mean Difference	t	Sig.
Literal	Pre-test	6.3158	-1.5263	**-3.683****	**.002**
	Post-test	7.8421			
Interpretative	Pre-test	2.6842	-1.8947	**-3.473****	**.003**
	Post-test	4.5789			
Critical	Pre-test	1.4211	-0.7894	**-2.395***	**.028**
	Post-test	2.2105			
Creative	Pre-test	.7368	-1.0527	**-4.472****	**.000**
	Post-test	1.7895			

**Highly Significant at 0.01, *Significant at 0.05

The study of Zeng (2007) also supports this particular result of the study particularly in the mental strategies performed by the students as they listened while doodling. In their study, they emphasized the mental processes which a person is involved in listening. Specifically this processes involve top-down and bottom-up. Although it is not measured in this study, the extent of top-down and bottom-up processing of the students may have also be reinforced by their doodles. For example, in the analysis of their doodles, it was found out that the metacognitive doodles increases as the students gets their way to understanding the lecture- or conversation-type of listening passage. Hence, the from their stored knowledge or schemata, the students were able to relate the content of the listening passage and thus their doodle output resulted to meta-cognition, whereby their doodles reflect what is happening in the listening passage and what they understand about it.

Furthermore, although more extraneous doodles were produced, it only reflects that he students when get bored consistently kept their minds active. This leads to another possible reason as to why they were able to improve their levels, that is, it is the act of doodling itself that has influenced the students to focus on what they were listening to. This has been studied overtime when Adrade (2009) pioneered the effect of doodling to concentration. Although her study was the first to bravely attempt to reduced mind wandering by day-dreaming, the results paved way for the a hallmark discovery, in which later researchers ventured on affirming and even enhancing the claim. Schott (2011) supported her claim, which also supports the results of the present study, by emphasizing that doodling helps stabilize arousal and helps a person increase watchfulness, hence, the increased in the level of students' listening comprehension may be attributed as a result of the exposure to doodling.

On the Difference between the Pre-Test and Post-Test Mean Scores of the Students Not Exposed to Doodling

Table 13 shows that along literal, interpretative, and critical levels of listening comprehension, the t-computed values (literal with .000; interpretative with -2.088; & critical with -1.17) had associated significance values (literal with 1.000; interpretative with .51; & creative with .279) lower than the 0.05 level of significance. Hence, the null hypothesis is accepted for these three levels. This indicates that the pre-test and post-test mean scores of the students not exposed to doodling are not significantly different.

However, along creative level, the t – computed value of -2.535 had an associated significant value of .021 which is lower than 0.05 level of significance. Hence, for this particular level, the null hypothesis is rejected. This means that the pre-test and post-test mean score of the students not exposed to doodling along creative level are significantly different. This further means that their post-test mean score in creative level is significantly higher than their pre-test mean score in the same level.

Table 13. Difference between the Pre-test and Post-test Mean Scores of the Students Not Exposed to Doodling

Comprehension Level along:	Score	Mean Level	Mean Difference	t	Sig.
Literal level	Pre-test	5.9474	0	.000[ns]	1.000
	Post-test	5.9474			
Interpretive level	Pre-test	2.3158	-1.0526	-2.088[ns]	.051
	Post-test	3.3684			
Critical level	Pre-test	1.1053	-0.421	-1.117[ns]	.279
	Post-test	1.5263			
Creative level	Pre-test	.9474	-0.7894	**-2.535***	**.021**
	Post-test	1.7368			

[ns]Not Significant; *Significant at .05

The results presented in this section are rather stimulating because, from the series of listening test experienced by the respondents, the skills in comprehending literal, interpretative, critical information did see any improvements. It is to be understood then listening comprehension skills might not necessarily be improved even when the listener himself thinks he is concentrating. This is explained in the study of Smallwood & Schooler (2006) claiming that while the listeners think that they are concentrating on the listening passage, their brain engages in daydreaming and other task-unrelated thoughts (TUTs) especially when the listener starts to feel boredom and attempts to relieve it. Hence, upon attempting to relieve boredom by daydreaming, the listener is being led away from the details of the passage.

It is also very apparent in the results that only in creative comprehension where the students

improved as reflected in their post-test scores. This result implies that although the respondents maintained their levels in those three levels, they improved significantly in creative level, i.e. "handling verbal and non-verbal communicative strategies, identifying hesitation and prop words, and making appropriate response" (Al-Musalli, 2001). This is supported the study of Anderson (1977, cited by Yenkimaleki & Van Heuven, 2016) that their knoweledge in acknowledging hesitations and determine their comprehension which involves the activation of their schema. The listeners attempt to relate the details of the listening passage with the schemata and see the connection for better understanding. Thus the schema is activated as soon as the listeners find various parts of the listening passage familiar to them.

On the Difference between the Levels of Listening Comprehension of the College Students Exposed To Doodling and Those That Are Not

As reflected in Table 14, the findings revealed that in the literal level, the resulting t-computed value, which is 2.192, had the significance value of .035 below the 0.05 level of significance. Hence, the null hypothesis is rejected. This means further that the level of listening comprehension of the college students exposed to doodling is significantly higher than those who were not in terms of literal comprehension. However, the t-computed values of interpretative (2.018), critical (1.513), and creative levels (.127) had corresponding significance values (interpretative with .51; critical with .139; & creative with .900) higher than the 0.05 level of significance. Hence, the null hypothesis is accepted. This means further that there is no significant difference between the level of listening comprehension of college students exposed to doodling and those who were not along interpretative, critical, and creative levels.

Table 14. Difference between the Level of Listening Comprehension of the College Students Exposed to Doodling and those that are Not Exposed to Doodling Activities

Comprehension Level along:	Group	Mean	Mean Difference	t	Sig.
Literal	Students exposed to doodling	7.8421	1.8947	**2.192***	**.035**
	Students not exposed to doodling	5.9474			
Interpretive	Students exposed to doodling	4.5789	1.2105	2.018^{ns}	.051
	Students not exposed to doodling	3.3684			
Critical	Students exposed to doodling	2.2105	0.6842	1.513^{ns}	.139
	Students not exposed to doodling	1.5263			
Creative	Students exposed to doodling	1.7895	0.05270	.127^{ns}	.900
	Students not exposed to doodling	1.7368			

^{ns}Not Significant *Significant at 0.05

These findings only illustrate that based on the taxonomy of Al-Musalli (2001) doodling may have aided the students in improving their skills in recognizing or recalling main ideas, understanding the gist of what was said, identifying relevant points and rejecting irrelevant points.

Thus, the results of present study affirm and reason with the conclusions of mentioned studies about the effect of doodling on listening.

For example, Andrade (2009) published her study, "What does Doodling do?" – the first published study about doodling and listening – and revealed her discovery that doodling aided to concentration. In her study, she found out that those who doodled remembered more names than those who did not, hence, recall ability. Thus, the present study is in coherence with the results of Andrade's that doodling aids to recalling or remembering of details and as referenced to the taxonomy of Al-Musalli (2001), main ideas.

Furthermore, the present study agrees with Tadayon and Afhami (2016) that doodling improves learning. Their study assessed the effects of doodling on learning performance and found out that those who doodled outperformed those who did not. Such a result drew the implication that doodling was beneficial particularly in learning. However, what lacks in their study is the non-identification on what area of learning was measured. Hence, the present study drove its focused on the comprehension levels and attempted to find which of these areas would receive a positive impact of doodling. As a result, only in literal comprehension was doodling beneficial and not in higher comprehension levels, i.e., interpretative, critical, and creative.

However, the study conducted by Boggs et al. (2017), a supposed "replication and extension" of Andrade's (2009), arrived at a rather different and contradicting result. Their study focused on employing structured and unstructured doodling, and note-taking to see whether doodling can have beneficial effects on comprehension. As it turned out, doodling, whether it be structured or unstructured, did not make any significant effects on the performance of the respondents while note-taking did. They then concluded that doodling may not be advantageous at all in increasing recall performance because they found no support that doodling improved the recall ability of their participants. The results of the present study reasons with Boggs's et al. about the effect of doodling on the recall performance of the respondents since the former found out that the effects of doodling are significant in this level of comprehension.

Initially, the present study posed an ambition to see whether doodling can also aid in higher levels of comprehension, but as the findings revealed, the effects of doodling to these higher levels of listening comprehension, i.e. interpretative, critical, and creative, are no better than just listening. Hence, the results of this study adds, to the literature of the effects of doodling, the limitation of its effects on listening comprehension, that is, doodling can be used to aid in literal comprehension and may not be more beneficial in improving skills in higher levels of comprehension than not doodling at all.

On the Relationship Between the Profile Variables and the Listening Comprehension Levels of the College Students Not Exposed To Doodling and Those That Are Exposed To Doodling Activities

As for the students who were not exposed to doodling, the result of the statistical computations, which is presented in Table 15, revealed that the significance values across all profile variables are higher than the 0.05 level of significance from the variables were tested. Hence, the null hypothesis is rejected. It therefore means that there is no significant relationship between the profile of the students not exposed to doodling activities and their listening comprehension levels. Further, this suggests that their profile is not significantly associated with their performance wherein their profile had no influence on their levels.

Table 15. Relationship between the Profile variables and the Level of Listening Comprehension of the College Students that are Not Exposed to Doodling Activities

Profile	Listening Comprehension							
	Literal Level		Interpretative Level		Critical Level		Creative Level	
	r	Sig.	R	Sig.	r	Sig.	r	Sig.
Sex	-.092	.708	-.359	.132	.010	.966	.098	.690
Age	-.040	.872	-.001	.996	.019	.937	-.219	.368
First Language	.152	.534	-.066	.789	-.122	.619	.335	.161
Verbal Reasoning score in the entrance examination	-.001	.998	.144	.558	.007	.976	-.159	.515

As for the students who were exposed to doodling activities, the result of the statistical computation shown in Table 16 does not differ much from those that were not exposed as their computed significance values were also higher than the 0.05 level of significance. Thus, across all profile variables, the null hypothesis is rejected. This indicates that none of the profile variables is found to be significantly correlated on the level of listening comprehension of the college students are exposed to doodling activities.

Table 16. Relationship between the Profile variables and the Level of Listening Comprehension of the College Students Exposed to Doodling Activities

Profile	Listening Comprehension							
	Literal Level		Interpretative Level		Critical Level		Creative Level	
	r	Sig.	R	Sig.	r	Sig.	r	Sig.
Sex	.258	.287	-.006	.979	.175	.473	.188	.441
Age	-.066	.790	-.364	.126	-.139	.569	-.241	.321
First Language	.166	.496	-.198	.418	.116	.635	.192	.432
Verbal Reasoning score in the entrance examination	.102	.679	-.051	.837	.035	.885	.150	.539

Moreover, since their performance in the listening comprehension test came about a result after the student's exposure and non-exposure to doodling activities, the findings also imply that the profile variables did not affect the rate of effectiveness of the intervention strategy. This means that despite the application of treatment to the experimental group, their performance was still a result of the length of their exposure and type of stimuli or the listening passages which both groups were exposed to during the experiment.

Conclusions

Based on the salient findings of the study, the following conclusions were drawn.

1. The Bachelor of Science in Development Communication in Tarlac Agricultural University is dominated by females. The typical language first learned by the respondents is Filipino. In the entrance examination, majority of the respondents had above average scores (80-89) in verbal reasoning. They also vary in their way of learning and are dominant in one or more than one learning styles.
2. The students who were exposed to doodling improved on all levels of listening comprehension. The students who were not exposed to doodling improve only on literal, interpretative, and creative comprehension but not in critical.
3. The students exposed to doodling activities produced various doodles as they participated in the listening activities. Most of these doodles are extraneous, or doodles that have no connection with listening passage at all. This majority was followed by meta-cognitive doodles which reflects the efforts of the students to track their understanding of the passage.
4. Doodling can be beneficial in improving listening comprehension as evidenced by the increase of the number of respondents possessing improved levels of listening comprehension skills.
5. Doodling may significantly aid in improving literal comprehension but its benefit on the improvement of interpretative, critical, and creative comprehension levels may not be significant.
6. The students' age, sex, first language, and verbal reasoning score in the entrance examination are not significantly associated with their performance in the listening comprehension tests. Hence, the positive effect of doodling is not profile sensitive.

Pedagogical Implications

While most strategies that have been devised to improve listening comprehension have worked out in the past, EFL and ESL teachers continue to search for more and newer strategies to use. Based on the the results of the present study and the previous studies, doodling can be considered a new strategy to help struggling students comprehend listening transcripts better. As established, concentration is enhanced when doodling is performed (Andrade, 2010). With narrower direction, where doodling aids in improving literal comprehension, teachers and even students may opt to allow doodling when targeting foundational areas of comprehension.

As Smallwood et al. (2007) put it, one's environment, in order to have meaning, must coordinate with one's internal representations. Doodling introduces a way that would strengthen this relationship as it gradually decreases day-dreaming by attempting to forbid the entry of task-unrelated thoughts to one's mind. With the consistent exposure of the students to doodling while listening, they developed a strategy to learn better coordination and prevent too much entry of task-unrelated thoughts. Hence, better coordination happen led to better comprehension.

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Effectiveness of Utilizing Graphic Organizers in Improving Conceptual Understanding towards Operations of Fractions among Teachers

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Fraction is the most abundant and most complicated topics in mathematics and also prerequisite to successful operations in major mathematical processes. The goal of the study is to look into the effectiveness of utilizing graphic organizers in improving the conceptual understanding towards operations of fractions and its relationship with attitude towards graphic organizers. The study implemented quasi-experimental design particularly Solomon Four-Group design. A total of one hundred sixteen subjects (N = 116) from the College of Teacher Education, Tarlac State University, Philippines used in the study. The study sought to find out whether there was a difference in post instructional conceptual understanding when learners undergone to graphic organizers. Descriptive statistics and inferential statistics were used for data analysis. The findings revealed that when learners are exposed to graphic organizers, their scores and level of conceptual understanding are improved ($F = 13.477$, $p < 0.01$). Graphic organizers is more effective in solving problems towards operations of fractions than using the traditional method. The study established that graphic organizers is an effective approach in improving the conceptual understanding and thus mathematics teachers ought to integrate in their teaching. A Pearson r correlation showed that the relationship between attitude and conceptual understanding is not significant for the first treatment, and significant for the second treatment.

Keywords: graphic organizers, conceptual understanding, Solomon four group design, fractions, mathematics education

INTRODUCTION

Most learners see mathematics as a challenging subject because of its disagreeable teaching approach, which makes it challenging to follow instructions, grasp the subject, recall its equations and methods for solving problems, and, most importantly, remember the term and the concept itself. Through this, learners start to decline the opportunity to

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learn mathematics that will lead to the disliking of the subject. Mathematics is indeed a challenging yet a helpful subject.

One of the challenging topics in Mathematics that most learners refused to appreciate is the concept of fractions. Fractions involve challenging-to-learn and challenging-to-teach concepts that present pedagogical challenges to the Mathematics education community. In layman's term, according to study.com a fraction simply indicates how many components of a whole there are. A fraction may be identified by the slash (vinculum) that is placed between the two integers (numerator and denominator).

With regards to the number of learners who didn't appreciate the beauty of Mathematics. An article published by the Times of India in 2015 titled "The importance of maths in everyday life" said that Mathematics set our lives in order and prevents chaos. Mathematics is everywhere, whatever you do, and wherever you go its presence will always be there. You can't live without Mathematics.

"Seeing the links between ideas and methods, and being able to apply mathematical principles in a variety of contexts" is what conceptual knowledge entails. (Wong & Evans (2008) as cited in de Guzman & Mallari, 2013). Conceptual understanding is like a first line of defense when it comes in your battle towards mathematics, this helps you to decode and understand deep abstract concepts in mathematics. In his report titled "Conceptual Understanding of Fraction and Decimals" in (2004). Taris Washington stated that "Fractions are one of the most challenging math concepts for learners to understand." (Berry and Nyman (2003) as cited in Yatim et al, 2022) revealed that learner obtained meaningful learning through relationships and connections. Through the help of conceptual understanding learners used this to see connections, and relationships in order to successfully deal and answer whatever mathematical problems that may face.

As this world continues to evolve, new researches, methodologies and interventions are developed just to cater the growing number of learners specifically the 21st century learners. Since Mathematics is less appreciated most especially the concept of fractions, many of the concepts is still abstract and very often learners find it challenging to comprehend. Educators' biggest challenge is how to make the subject matter more interesting, exciting, and appealing to the learners. Bringing about the best and desired learning outcomes, instructional materials must select base on its effectiveness.

Method of instruction plays a vital role in the learners' academic achievement, there is a must and need in developing teaching strategies that will elevate, upgrade, and advance the standards of instruction. In answer to this, strategies and techniques used in teaching are proposed by the Department of Education (DepEd). One of these is the graphic organizers. Graphic organizers are spatial displays that employ lines, arrows, and diverse patterns to illustrate information and concepts' connections. (Darch & Carnine (1986) as cited in Condidorio, 2010). Over the last twenty-five years, there has been a sharp increase in study on graphic organizers and their influence on the learning process. In the study of (Tavsanli, Ulger, and Kaldirim, 2018), (Cala, 2019), and (Abdullaeva, 2020), shared similar results where utilization of GO revealed a useful, effective, and

significant effect. Ideally, GO helps the learners to see the fractional parts visually, also the concept of fractions registered twice– verbal and non-verbal, through this the abstractness of the fraction concepts lessens and has two opportunity to be learned. Because they emphasize essential concepts and terminology, as well as the links between them, graphic organizers assist learners focus on what is important (Bromley, DeVitis, & Modlo, 1995), they provide the tools for critical and creative thinking.

Learners frequently struggle with learning from books and lectures because material is usually arranged in blocks or lines that prevent essential links between ideas. Learners who utilize graphic organizers in the classroom have the capacity to use them independently as study aids for taking notes, planning, presenting, and reviewing (Dunston, 1992) and see mathematical concepts applied in their daily life (Steppler, 2020).

In the study of Harris Chaiklin (2011), he defined attitude as a verbal expression and behavior. Attitude also affects a person's way of thinking (Torres, 2019). This simply means that attitude can make a person worse or better depending on the external and internal influences. It either destroys learners or boosts the learners' interest and makes their journey more meaningful. (Syah, 2018), (Wangzom & Chalermnirundorn, 2019), (Syafizal, 2020), and (Chanshi & Daka, 2020) noted in their studies that there is a positive impact of the utilization of GO in their attitude. Attitude plays an important role towards a success in Mathematics endeavours. Having a positive attitude towards the usage of graphic organizers make the learners more interested, adds enjoyment, and give them drive to do more and discover and create their own graphic organizers. In other words, graphic organizers may help students learn both inside and outside of the classroom. This organizer may also be used to assist students in improving and developing their research and problem-solving abilities. Learners are taught how to plan their study and investigation of a topic, enhancing their capacity to learn and think for themselves.

Furthermore, graphic organizers are viewed as a significant and helpful instructional aid due to their ability to organize thoughts and knowledge while also improving understanding of new material (McKnight, 2010). A study on using the GO and animation revealed a significant difference in the learning outcomes of students (Oginni, 2021). As a result, learners of all ages benefit from graphic organizers and visual symbols in subject-related tasks (Dye, 2000).

For as long as there are educators, there will be an enthusiastic search for superior instructional techniques. Taguine's (2014) study states that graphic organizers are not new they are commonly used in some schools and in other subjects but rarely in Mathematics. Through this study, graphic organizer was used and introduced to educators and learners who were not familiar with this method. The researcher aimed to determine the effects of utilizing graphic organizers in improving conceptual understanding towards operations of fractions among pre-service teachers of the Tarlac State University, Philippines during the second semester of academic year 2020-2021. This study was an attempt to prove the effectiveness of graphic organizers in improving conceptual understanding towards operations of fractions.

METHOD

Research Design

This study used quasi-experimental design in particular Solomon's four group research design. The Solomon four-group design is the marriage of the pretest–posttest design and the posttest-only design; two groups served as treatment groups and two groups served as control groups (Martella, Nelson, Morgan, & Marchand-Martella, 2013). Solomon's four group design was chosen to measure the effect of the utilization of graphic organizer as intervention versus the traditional teaching on the operations of fractions, while controlling for the potential effects of a pretest. According to Shuttleworth (2009) p.92 as cited by Muchiri1, Barchok & Kathuri (2015), "the design allows the researcher to exert complete control over the variables and to check the influence of pretest on the results." Also it increases the internal validity, easy to implement the document methodology, and assesses the pre-test sensitization. Solomon Four group design is as follow:

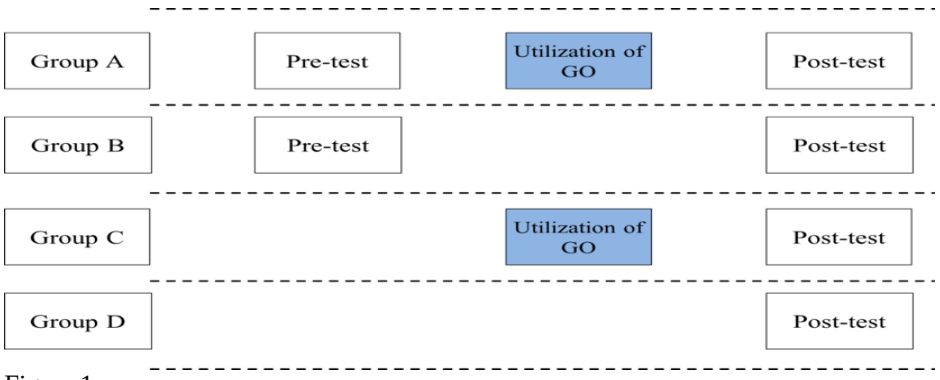

Figure 1
The Solomon's four group design

Subjects of the Study

The subjects of the study were the pre-service teachers specifically the first-year education students who are taking up Bachelor of Elementary Education (BEEd) in Tarlac State University, Philippines. Two sections were used in the study, BEEd 1-A composed of 56 students, and BEEd 1-B composed of 60 students. Each section was divided into 2 equal groups. All in all, this study had four set of groups, two treatment groups having 58 learners and two control groups having 58 learners, leading to 116 as total subjects for this study.

Table 1
Distribution of the subjects of the study

		Number of the Subjects
Treatment Group	Group A (T1)	28
	Group C (T2)	30
Control Group	Group B (C1)	30
	Group D (C2)	28
Total		116

Legend: T1 – first treatment group
T2 – second treatment group
C1 – first control group
C2 – second control group

Data Collection

Probability sampling in particular total enumeration sampling was used in choosing the subjects. Total enumeration sampling is a type of purposive sampling where the researcher chose to examine the whole population that have a particular set of characteristics and it helped also the researchers to potentially draw a much more complete picture and greatly reduced assumptions (Crossman, 2018 as cited in Glen, 2021).

The results were obtained from the learners' pretest, posttest, and attitudinal questionnaire outputs and evaluated by descriptive analysis, independent sample t-test, paired sample t-test, analysis of variance (ANOVA), and Pearson r correlation using the Statistical Package for Social Sciences (SPSS) version 20 software package in finding the mean scores.

Descriptive statistics such as frequency, mean, and standard deviation were used to determine the pre-service elementary teachers' pre and post instructional conceptual understanding towards operations of fractions and attitude towards graphic organizers.

A paired sample t-test was used to determine if the pre instructional conceptual understanding of learners towards operations of fractions were significantly different from their post instructional conceptual understanding towards operations of fractions. A significance level of $p<0.05$ was used in the statistics. Only the overall mean of the attitude and per cluster of the subjects was compared. Also, description was made to interpret the general attitude of the subjects towards graphic organizers with 1.00 – 1.75 as Strongly Disagree, 1.76 – 2.50 as Disagree, 2.51 – 3.21 as Agree, and 3.26 – 4.00 as Strongly Agree.

To determine and find out the significant effect of the intervention among and between the pre-service teachers' instructional conceptual understanding towards operations of fractions analysis of variance (ANOVA) was performed.

Finally, Pearson r bivariate correlation was used to determine the relationship between the attitude and conceptual understanding

Instruments

This study utilized two instruments namely the pretest and posttest questionnaires, and the attitudinal questionnaire.

The first instrument was the pretest and posttest questionnaires that consist of 20 items. The pre-test questionnaire was given to the subjects specifically two from the groups namely first treatment group- T1 and first control group- C1 to answer the questions about the operations of fractions. The content validity of the test was checked and validated by the experts from the Central Luzon State University, Philippines, College of Science- Department of Mathematics and Physics who have an intensive and sophisticated training in the field of Mathematics Education.

The second instrument was an attitudinal questionnaire designed to measure their attitude, in terms of liking, valuing, and confidence towards graphic organizers. This attitudinal questionnaire solely focused on the subjects' attitude in terms of liking the use of graphic organizers, how much they value the graphic organizers, and their confidence in utilizing the graphic organizers. The questionnaire is adapted from Al-Mutawah & Fateel (2017) as cited in Torres (2019) which measured the same parameters and contained 20 items. Al-Mutawah & Fateel (2017), and Torres (2019) attitudinal questionnaires have a Chronbach's Alpha reliability test results value of 0.629 and 0.66, respectively, both an acceptable values.

FINDINGS AND DISCUSSION

This part presents the findings of the analysis of the data obtained. It includes the pre and post instructional conceptual understanding towards operations of fractions, attitude towards graphic organizers, difference on the post instructional conceptual understanding among and between the four groups, difference between pre and post-instructional conceptual understanding of first treatment group and first control group, and correlation between attitude and conceptual understanding towards operations of fractions of first and second treatment groups.

Pre Instructional Conceptual Understanding towards Operations of Fractions

In order to assess the students' knowledge towards operations of fractions prior to the intervention, an analysis of the students' pre instructional scores was performed. The mean and standard deviation as well as the classifications of pre instructional scores for first treatment group (T1) and first control group (C1) are presented in Table 1.

Results in Table 1 shows that mean score for T1 and C1 for the pre instructional were 36.64 and 38.03, respectively out of a maximum score of 100 points. For the pretest of T1, out of 28 students, 1 scored satisfactorily, and 1 scored fair, both are 3.57%, and the remaining 26 from the group scored poor, and that was 92.86%. For the pretest of C1, out of 30 students, 30 or all students in the group scored poor having a 100%. The mean score for the two groups were bad. The results suggested that students' conceptual

understanding was poor. Due to the pandemic where everything is virtual, this added an extra challenge to the students where there's screen barrier and their attention is not solely focused on the lessons unlike in face-to-face setting. Also, this can be attributed to the fact that testing was done before teaching the topics under study. Low score in pretest was tantamount to poor conceptual understanding or background on the topics. Fraction is simple but a challenging topic in Mathematics. Study of Bruma & Guevara (2016) as cited in Diaz and Dio (2017) expressed similar results. It was found out that both the control and experimental groups performed poorly during the pretest.

Table 1
Classification of pre-instructional conceptual understanding of T1 and C1

Classification	Score Range	Pretest T1 $\bar{x} = 36.64$; SD = 15.82		Pretest C1 $\bar{x} = 38.03$; SD = 13.62	
		Frequency	Percentage	Frequency	Percentage
Outstanding	90-100	0	0	0	0
Very Satisfactorily	85-89	0	0	0	0
Satisfactorily	80-84	1	3.57	0	0
Fair	75-79	1	3.57	0	0
Poor	Below 75	26	92.86	30	100

Post Instructional Conceptual Understanding towards Operations of Fractions

Table 2 presents the post instructional mean scores and classifications towards operations of fractions among the four groups involved in the study

Results shows that out of 28 students from the posttest of T1, 2 scored very satisfactorily having a 7.14%. There were 26 students scored poor with 92.86%. For C1, out of 30 students, all in the group scored poor in the posttest and that was 100%. Posttest scores of T2 results shows that out of 30 students, 1 scored above very satisfactorily (3.33%), 1 scored satisfactorily (3.33%), 3 scored fair (10%), and 25 scored poor (83.33%). Lastly, for C2, out of 28 students, 28 from the group scored poor (100%). Control groups (C1 and C2) had mean scores of 39.20 and 47.93, respectively, and treatment groups (T1 and T2) had mean scores of 54.14 and 61.10, respectively out of a maximum score of 100 points. The treatment groups which were taught to utilize graphic organizers in solving operations of fractions problems had a higher mean score compared to control groups that were taught the traditional way of solving operations of fractions problems. Graphic organizers bridge the gap of abstraction, minimized the intensity and vagueness of the problem, and helped students decode easily what the problem is trying to imply. Making their own graphic organizers while solving made the learning meaningful for the information are coded twice and gave the students two opportunities in learning. Also, through the students' own graphic organizers, it minimizes cognitive load. Heavy cognitive load can have negative effects on tasks completion and retention and when

they kept on using it can become overloaded, and learning does not take place. So, graphic organizers help in reducing the loads. Hence, reducing cognitive load may increase learning. The present study was supported by the results of the study of Guevara (2016) as cited in Diaz and Dio (2017) where the study reported that both the control and experimental groups improved in their posttest performances.

Table 2
Classification of post instructional conceptual understanding of the four groups

Classification	Score Range	Posttest							
		T1		C1		T2		C2	
		f	%	f	%	f	%	f	%
Outstanding	90-100	0	0	0	0	0	0	0	0
Very Satisfactorily	85-89	2	7.14	0	0	1	3.33	0	0
Satisfactorily	80-84	0	0	0	0	1	3.33	0	0
Fair	75-79	0	0	0	0	3	10	0	0
Poor	Below 75	26	92.86	30	100	25	83.33	28	100
Mean		54.14		39.20		61.10		47.93	
Standard Deviation		13.15		15.28		13.84		12.90	

Attitude towards Graphic Organizers

One objective of the study was to determine the attitude of the first and second treatment groups after receiving instructions using graphic organizers. Table 3 and Table 4 presents the T1 and T2 attitudes in terms of liking graphic organizers, valuing graphic organizers, and confidence on graphic organizers.

Table 3 shows that the first treatment group's (T1) attitude towards graphic organizers had an overall mean of 2.97 and SD of 0.29 with a description of "agree". This implies that the group showed positive and favorable attitude towards graphic organizers.

In terms of liking graphic organizers the group had a pooled mean of 3.34 and SD of 0.213 described as "strongly agree". This showed that majority in the group do like graphic organizers.

Second cluster was in terms of valuing graphic organizers. The group had a pooled mean of 3.17 and SD of 0.150 translated as "agree". This tells that majority in the group really do care and value graphic organizers.

In terms of confidence in graphic organizers, the group had a pooled mean of 2.64 and SD of 0.326 translated as "agree". This means that the group showed confidence in

graphic organizers. After the intervention the learners felt confident already in using the graphic organizers (Robson; Farooq& Shah (2008), as cited in Duque and Tan 2018).

Table 3
First treatment group's (T1) attitude mean scores towards graphic organizers

Statements	Mean	Standard Deviation	Description
Liking Graphic Organizers	3.34	0.213	Strongly Agree
Valuing Graphic Organizers	3.17	0.150	Agree
Confidence on Graphic Organizers	2.64	0.326	Agree
Overall Mean	*2.97*	*0.29*	*Agree*

Legend: * Statements that were reversely coded
1.00 – 1.75 = Strongly Disagree (SD)
1.76 – 2.50 = Disagree
2.51 – 3.25 = Agree
3.26 – 4.00 = Strongly Agree (SA)

Table 3 shows that the second treatment group's (T2) attitude towards graphic organizers had an overall mean of 2.71 and SD of 0.13 with a description of *"agree".* This implies that the group showed positive and favorable attitude towards graphic organizers.

In terms of liking graphic organizers the group had a pooled mean of 2.81 and SD of 0.178 described as *"agree"*. This showed that students in the group liked graphic organizers.

When it comes in valuing graphic organizers, the group had an overall mean of 2.84 and SD of 0.093 which translated as *"agree"*. The group really do valued graphic organizers.

The last cluster was in terms of confidence on graphic organizers. On this cluster, the group had an overall mean of 2.56 and SD of 0.094 which means *"agree".* This showed that the learners had an optimistic confidence in graphic organizers, after the intervention the learners felt confident in using the graphic organizers. Being equipped in GO boosted your confidence and confidence gives courage that is one of the ingredients of a successful endeavor. Similar results as reported in the study of Mann (2014) where he narrated that a quiet and shy-type student gradually is participating and giving answers. Through the use of GO as their study guides it was seen that GO helped in improving performance of the learners in class.

Table 4
Second treatment group's (T2) attitude mean scores towards graphic organizers

Statements	Mean	Standard Deviation	Description
Liking Graphic Organizers	2.81	0.178	Agree
Valuing Graphic Organizers	2.84	0.093	Agree
Confidence on Graphic Organizers	2.56	0.094	Agree
Overall Mean	*2.71*	*0.13*	*Agree*

Legend: * Statements that were reversely coded
1.00 – 1.75 = Strongly Disagree (SD)
1.76 – 2.50 = Disagree
2.51 – 3.25 = Agree
3.26 – 4.00 = Strongly Agree (SA)

Difference on the Post Instructional Conceptual Understanding among and between the Four Groups

This inquiry aimed to determine and differentiate the four groups. Table 5 presents the results of the analysis of variance (ANOVA). Descriptive statistics shows that the mean of first treatment group (T1) is 54.14 with an SD of 13.145, first control group (C1) mean is 39.20 with an SD of 15.284, second treatment group (T2) mean is 61.10 with an SD of 13.839, and second control group (C2) mean is 46.93 with an SD of 12.904. Levene's test shows that the data is homoscedastic, *($F = 0.308$, $p > 0.05$)*, indicating that there are no significant differences on the variance of the four groups. Thus, data were homogenous.

Analysis of Variance was performed to determine the effect of groupings to post instructional scores. Results show that groupings have significant main effect to the post instructional scores, *$F (3, 112)= 13.477$, $p < 0.05$*. Since the analysis is significant, post hoc was examined to determine which pair/s of means are different. The multiple comparison using Scheffe shows that the difference between T1 and T2 was not significant (*$p = 0.307$ which is $p > 0.05$)*, T1 and C2 was not significant (*$p = 0.424$ which is $p > 0.05$)*, and C1 and C2 was not significant (*$p = 0.307$ which is $p > 0.05$).* However, the difference between T1 and C1 was significant (*$p = 0.001$ which is $p < 0.05$)*, C1 and T2 is significant (*$p = 0.000$ which is $p < 0.05$)*, and T2 and C2 was significant (*$p = 0.006$ which is $p < 0.05$)*. Among the six pairs of means, three were found to be significantly different: T1 vs C1 between C1 vs T2 and between T2 vs C2.

T1 *(mean = 54.14)* and C1 *(mean = 39.20)* were found to be significant this mean that T1 was significantly higher than the C1. T1 and C1 both had pre-instructional test and post instructional test, this mean that by comparing the final post test results between the two groups it was found out that the intervention was effective. GO gives better

representation of works and leads to a more efficient and successful outcome. Therefore, graphic organizers aided students in improving their conceptual understanding.

T1 *(mean = 54.14)* and T2 *(mean = 61.10)* were found to be not significant, meaning both treatment groups were statistically the same. T1 and T2 were both underwent intervention and post instructional test, the only difference of the two groups was T1 had pre-instructional test. The comparison between T1 and T2 post instructional test showed and determined that there were no pre sensitization or the pre-test has no effects on T1, therefore the study was successful. GO served as a guide on how to start answering a problem solving, this simply mean that GO helped students to digest and break down problem solving and arranged it in an simpler and easy to understand manner. Being said by this, learning is within reach of the students who utilized GO as compared to a broader and complex way that traditional way offered. Thus, T1 and T2 both improved in their conceptual understanding through the help of graphic organizers.

T1 (*mean = 54.14*) and C2 *(mean = 47.93)* were found to be not significant. First treatment group who underwent pre-instructional test, intervention, and post instructional test were statistically the same to second control group who were undergone only to post instructional test. GO has deep processing of concepts, this simply mean that T1 who undergone and utilized graphic organizers performed better as compared to C2 even if they will improve the traditional way of teaching, performance of the C2 will not match the performance of T1.

C1 *(mean = 39.20)* and T2 *(mean = 61.10)* were found to be significant this mean that T2 was significantly higher than the C1. C1 had pre instructional test and post instructional test while T2 had intervention and post instructional test. By comparing their final post-test, results show that group who underwent to intervention was found to have a better performance as compared to the group who did not undergo to intervention. Graphic organizers helped in achieving higher order thinking skills (Quist, 1995). Higher Order Thinking skill is a concept introduced by the Americans where in it distinguishes critical thinking skills. Critical Thinking skills is a must have skill in order to have a smooth sailing journey in dealing problem solving. Having said this, possessing these two thinking skills may give a higher and intensive learning. Therefore, graphic organizers helped students in improving their conceptual understanding and seemed to be more effective as a tool in solving operations of fractions.

C1 *(mean = 39.20)* and C2 *(mean = 47.93)* were found to be not significant. C1 and C2 are both control groups who had post instructional test, the only difference of the two control groups was C1 had pre instructional test. By comparing their final post-test, results show that the pre-test itself did not affect behavior, independently of the intervention. Not significant result implies that the act of pre testing does not influence the overall results between the control groups. Hence, both control groups performed the same and statistically similar.

T2 *(mean = 61.10)* and C2 *(mean = 39.20)* were found to be significant. T2 and C2 both didn't have pre-instructional test and have post instructional test. T2 had undergone intervention while C2 did not. Comparison between T2 and C2 allowed the students to

determine if the actual act of pretesting influence the result. If the difference between the post instructional results of T2 and C2 was different from the T1 and C1, then it was assumed that the pre testing has had some effect on the results. As shown in the previous discussion, results of T1 and C1 were also significant this imply that T1 and C1, and T2 and C2 were statistically the same. Therefore, pretesting does not have effect in the results. Though GO for some students are confusing for the reason that they didn't know how to start and time consuming to draw, label, and make the GO pleasing to the eye. GO is utilized to enhance idea understanding and bridge the gap between previous knowledge and new information and as the results shown T2, a group who undergone intervention performed better than to C2 who does not undergone intervention. Thus, graphic organizers helped in improving conceptual understanding towards operations of fractions.

Performances of both the treatment groups and control groups did not have significant difference. This means that the subjects who underwent to the intervention which taught in utilizing graphic organizers in solving operations of fractions performed at the same higher level while the subjects who were taught traditional way of solving operations of fractions performed at the same lower level. Table 4 supports this when it showed in the mean that the two treatment groups (T1 and T2) got the first two highest mean and beyond half of the total score, while the mean of the two control groups (C1 and C2) were at below the half of the total score.

Therefore, even if the traditional method of solving the operations of fractions can improve the performance of learners is still the same and utilization of graphic organizers in solving operations of fractions produces and develops a favorable outcome. Hence, utilizing graphic organizers is more effective than the traditional method in developing the conceptual understanding of the pre-service teachers.

GO has promising results and increase the fraction performance of the learners. Utilizing GO yielded to a lesser confusing problem solving as compared to a more abstract in the traditional way of teaching way of solving. Hearing math specifically problem solving posed a scary feeling towards students, it made them nervous in worst mental blocked. Through utilization of GO these feelings lessened and sometimes eliminated. Furthermore, they aided in increasing creativity by allowing for greater flexibility in thinking and perception of information. They have cleared their thinking, helping them to solve their problems, to make decisions and take action, and to develop their memories and understanding (Krasnic, 2011 as cited in Kansızoğlu, 2017).

The study of Namasaka, Mondoh and Keraro as cited in Diaz and Dio, 2017 also revealed that there was a significant difference among the four groups in their study. The average of second treatment group (T2) *(Mean = 61.10, SD = 13.8)* was the highest.

Table 5
Difference on the post instructional conceptual understanding towards operations of fractions among the four groups after receiving instruction using graphic organizers and traditional way of teaching

Group	Mean	SD	df	F	P
T1 (n= 28)	$54.14_{a,b}$	13.145	3, 112	13.477	.000
C1 (n= 30)	39.20_{c}	15.284			
T2 (n= 30)	61.10_{a}	13.837			
C2 (n= 28)	$47.93_{b,c}$	12.904			

Note: Means with the same subscripts are not different using Scheffe post

Legend: T1- first treatment group with pre instructional test
T2- second treatment group without pre instructional test
C1- first control group with pre instructional test
C2- second control group without pre instructional test

Difference between Pre and Post Instructional Conceptual Understanding of First Treatment Group (T1) and First Control Group (C1)

Paired sample t-test was performed. Results shows below that the pre instructional test mean for T1 having 28 subjects was 36.64 and the SD was 15.819 while the post instructional test mean was 54.14 and SD was 13.5. The mean difference was -17.500. The computed t- statistics $(t_{27} = -6.801, p = 0.000)$ which is $p < 0.05$, even less than $p < 0.001$. While the pre instructional test mean for C1 having 30 subjects was 38.03 and the SD was 13.622 while the mean post instructional test was 39.20 and SD is 15.28. The mean difference was -1.167. The computed t- statistics $(t_{29} = -0.499, p = 0.621)$ which is $p > 0.05$.

This implies that the level of conceptual understanding of the subjects in T1 towards operations of fractions in the post-instructional was higher compared to their pre instructional test. This better performance was largely influenced by the treatment they had received. GO only highlighted the important concepts in the problem. Through this, other add-ons on the problems were eliminated making the learners enjoy and feel the light feeling on problem solving. Moreover, first treatment group who taught in utilizing graphic organizers in solving problems has significant difference as compared to first control group who was taught the traditional way. GO was more systematic, more enjoyable, and built students sense of fractions. This outcome showed match to the studies conducted by Taguines (2014), Uba, Oteikwu, Onwuka and Eniayekan (2017), Decin (2010), and Rusin (2003), where they firmly announced that GO provided a meaningful learning that aided students in improving their academic performances. Thus, graphic organizers seem to be effective in improving the conceptual understanding of the learners.

Table 6
Difference between the pre instructional and post instructional conceptual understanding of first treatment group and first control group

Group	Conceptual Understanding	Mean Difference	t	Standard Deviation	P
T1	Pre-Instructional-Post-Instructional	-17.500	-6.801	13.62	.000
C1		-1.167	-.499	12.79	.621

Correlation between Attitude and Conceptual Understanding towards Operations of Fractions of First and Second Treatment Groups (T1 and T2)

In finding the correlation between attitude and conceptual understanding of the subjects towards operations of fractions, only the overall mean of the attitude and post instructional conceptual understanding scores were used in the analysis.

Table 7 shows the result of the correlation between attitude and conceptual understanding towards graphic organizers. Based on the results, the relationship between attitude and conceptual understanding of the subjects towards graphic organizers was weak and not significant *($r = 0.241$, $p > 0.05$, for T1)*. This means that students from T1 who possessed a positive attitude towards the graphic organizers do not necessarily have high conceptual understanding. Same results in the study of Torres (2019) attitudes and conceptual understanding were not significantly correlated. He stated that non- diverse of respondents contributed to the result of the study.

Interestingly, moderate and significant results for T2 *($r = 0.459$, $p < 0.05$)*. This implies that, students who possess a positive attitude towards graphic organizer moderately have high conceptual understanding. In echo to the result of Humbert (2014) the use of graphic organizers gave positive feeling, drive and motivation in their work and learning. This shows that learners who used GO has better performance in writing and delivering information (Souisa, 2020). Also, Al-Mutawah & Fateel (2018) as cited in Torres (2019) reported a significant correlation between the learners' conceptual understanding and their attitude towards mathematics. Their study involved a much larger and diverse set of respondents, totaling to 624 respondents coming from different secondary grade levels and schools.

Table 7
Relationship between the first and second treatment groups' conceptual understanding towards operations of fractions and their attitude towards graphic organizers

Group	Correlation of Attitude and Conceptual Understanding	R value	P
T1	Attitude and Conceptual Understanding	.241	.306
T2		.459*	.042

*. Correlation is significant at the 0.05 level (2-tailed)

CONCLUSION

The study focused on testing the effectiveness of utilizing graphic organizers which are beneficial to the teaching-learning process. This study aimed to measure their usage in teaching Mathematics particularly to the operations of fractions among the Pre-Service Teachers of Tarlac State University, Philippines in improving their conceptual understanding. Attitudes of the subjects were also obtained to know how they relate towards graphic organizers. The Pre-Service Teachers focused only in utilizing area diagram and number line since graphic organizers have too many kinds and types. From the results, the implications of the study to educational teaching were drawn.

Purposely, only first year pre-service elementary teachers of the College of Teacher Education during second semester of academic year 2020-2021 were the scope of this inquiry.

Based on the findings, the following conclusions were drawn:

1. The pre-instructional conceptual understanding of the first-year elementary education students towards operations of fractions was below average or poor. First treatment group (T1) and first control group (C1) were similar or on the same level of conceptual understanding towards operations of fractions before the intervention was applied.
2. The post-instructional conceptual understanding of the first-year elementary education students towards operations of fractions had an improvement. In specific manner, the treatment groups (T1 and T2) scores exceeded the average level while the control groups (C1 and C2) remained on below average line.
3. Overall Attitude towards graphic organizers of first and second treatment group showed a favorable and positive insight especially in the cluster of liking graphic organizers, valuing graphic organizers, and confidence on graphic organizers.
4. The findings revealed that there was significant effect on the post instructional scores among and between the four groups. Further test performed and results showed that, utilization of graphic organizers is effective in improving conceptual understanding towards operations of fractions. Moreover, pretest sensitization has no effect in this study.
5. The findings revealed that group who underwent treatment had higher scores compared to those group who are taught in traditional way.
6. The relationship between the first treatment group's (T1) attitude towards graphic organizers and conceptual understanding towards operations of fractions of first year elementary education students were found to be not significant. This means that learners who showed a positive attitude towards graphic organizers will not certainly show a good conceptual understanding towards operations fractions. While in second treatment group's (T2) attitude and conceptual understanding found to be significant. This means that learners who showed a positive attitude towards graphic organizers will certainly show a good conceptual understanding towards operations fractions. This discrepancy between the treatment groups may

be caused by time and schedule of the study and volume of school requirements of the learners during the conduct of the study.

The researcher concluded that learners learn more and developed an improvement of the conceptual understanding towards operations of fractions utilizing graphic organizers. In this method, learners utilized graphic organizers specifically area diagram or number line in solving worded problems about operations of fractions. GO made easier the process specifically those students who were challenged. It also creates a meaningful learning and enjoyment to the learners because of the chance to do their own organizers than the traditional way. Involvement in graphic organizers, exhibited better retention and better performance.

RECCOMENDATIONS

This study revealed the effectiveness of utilizing graphic organizers in improving the conceptual understanding.

In order to see the success of utilization of Graphic organizers and obtaining its full effect and application, learners first need to be equipped in the basic and foundational concepts and topics such as fractions, numerator, denominator, proper fractions, improper fractions, similar fractions, dissimilar fractions, mixed fractions, equivalent fractions, and least common denominator. Mastery/ familiarity of the basic and foundational skills (as mentioned above) in fractions are recommended for better result.

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Correlates of School Support and After School Activities to Academic Performance of the Tau Student Athletes SY 2018 - 2019

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Abstract

The purpose of this study is to propose a sports development program for the university by determining how school support and after school activities affect the student-athlete performance of Tarlac Agricultural University. This study aims determine the importance of school support and school activities of the student-athletes of Tarlac Agricultural University. The study used descriptive-correlational research design to find relationships of the variables involved. The salient findings of the study are as follows: That there were more male student-athletes than female, most of the student-athletes involve in ballgames as sports discipline and most of the student-athletes were middle performers. On the school support, the student-athletes of the university has training and clothing allowance. But claimed that they have no monthly allowances, athletes' insurance, and housing. It was also found out that most of the student-athletes were hooked up in social media platforms as their after school activities, rather than to work on their courses' requirement, training for improvement and hanging out with friends. On the relationships, it was found out that there is a significant relationship between the after school activities of student-athletes to their academic performance. With regards to the after school activities of student-athletes and to their athletic performance, it was found out that these two were significantly related based on the data gathered. It was also found out that there is a significant relationship between the athletic performance of the student-athletes to their academic performance.

Keywords— Student-athletes, school support, school activities, academic performance

I. INTRODUCTION

Sports have become a major shift and attraction for students nowadays in the Philippines. The prints, radio, television and internet media have contributed much to the popularity of both professional and amateur sports in the country. Millions of pesos if not billions of pesos are spent on the upgrading of sports facilities and training of athletes. It is not surprising, that the popularity of sports has been reflected in the programs of every colleges and universities in the country. As reflected in Article 15, Section 19 of the 1987 Philippine Constitution that " the State shall promote physical education and encourage sports programs, league competitions, and amateur sports, including training for international competitions, to foster self-discipline, teamwork, and excellence for the development a healthy and alert citizentry." Also, under Section 6 of Republic Act 6847 mandates the Philippine Sports Commission (PSC) to set the priorities and direction of a national sports agenda, giving emphasis to grassroots participation.

Multiple times a year throughout the country, researchers, administrators, students, sports fans, and coaches gather at sport-related conferences to hear panels debate the most predominant issues and how they will affect the future landscape of sports in the country. Athletics versus academics has been at the forefront of sports in colleges and universities

for many years and serves as the underlying questions for other issues as well.

In SCUAA student athletes must carry a load of at least 12 units per term and maintain a 60 percent passing mark. The rules are non-negotiable as they should be because no league will want a varsity athlete playing for a school without going to class or flunking his course. This means student athletes must know how much to sacrifice in academics for sports because if they forego studies completely, they jeopardize their athletic eligibility. On his column, Sporting Chance, Joaquin Henson of Philippine Star, cite the program of Ambassador Cojuangco which started on the year 2013 – 2014, for the La Salle basketball men team. The program started with career visioning for athletes which has career counseling and testing, the program also include orientation of parents of athletes to explain the concept of the program. Dr. Coscolluela of La Salle, who conducted the program said, "The faculty will be oriented on the goals, policies and procedures of the varsity sports program, the practice schedules, the peak varsity competition periods which may require adjusted class schedules and make-up classes," she said. "The faculty will also be encouraged to use differentiated teaching strategies that enable students to find meaningful ways of learning that are attuned to their styles and domains of interest". Perhaps, other schools may consider undertaking a similar program to prepare their athletes for life after school.

Similarly, it is possible that athletic communities in state universities and colleges have developed a negative reputation with respect to the performance in academics. After school programs have become a developmental for young people but the current social, political and economic climate continue to pose the following challenges: funding, program sustainability and expansion, quality improvement and maintenance and programming to meet the needs of an increasing diverse group of athletes, this is according to James Bartlett Presbrey, (2017) on his study entitled "The Development and Sustainability of Sports-Based Youth Development Programs as a Viable Options for After-School Programs". Burns et. al. (2013), on their study "Academic Support Services and Career Decision-Making Self-Efficacy in Student Athletes", found out that academic support services were positively related to levels of career decision-making self-efficacy of student athletes.

Recent research has begun to investigate the influence of school support and after school activities to student athletes. Recently, the NCAA has created metrics to examine the academic performance of student-athletes such as the Academic Progress Rate (APR) and the Graduation Success Rate (GSR).Previous investigations have provided insights into the recent focus on academic performance of student-athletes. Grimit (2014) stated that, when it comes to education of student-athletes, most research focuses on GPA and traditional educational views. She also found out that student athletes do better in school than their peers.The broad goal of the Commission on Higher Education, however, is to prepare individuals for the rest of their lives and develop productive members of the society. Research suggests that participation in athletics is motivating student-athletes in the classroom in terms of better time management and motivation to attend classes, Byrd and Ross (1991). School varsity athletics provides an opportunity for holistic education, yet little research has been done to understand the overall impact of athletics through investigating the school support and school activities and the well-being of the student-athletes.

School varsity athletics supporters counter that the time commitments create structure and routine that often support academic success and can help overcome risk factors. Athletics participation itself provides non-traditional education that aids in the overall development of young people, contributes to increased academic performance of student-athletes. This was proven in the study of Gayles& Hu (2009), with their research findings that engagement and sport participation of students had also

motivated them to engage in educationally purposeful activities and the impact of their experiences on cognitive and affective outcomes.

As teachers, student advisers and coaches of student-athletes, the researchers noticed that there is not much research conducted in this area of endeavor, also the researchers observed that the factors involve in this study is not given priority in past researches conducted. This motivated the researchers to look into the importance of school support and after school activities of the student-athletes as to the relationship of their academic performance and athletic performance.

The purpose of this study is to propose a sports development program for the university by determining how school support and after school activities affect the student-athlete performance of Tarlac Agricultural University.

Sex		**Age**			**Athletic Involvement**					**Athletic Performance**		
M	F	16-18	19-21	22-25	Ball Games	Athletics	Martial arts	Archery	Swimming	Champion	Middle Performer	losing
30	25	20	30	5	24	15	8	6	2	2	45	8

Objectives of the Study

This study has the following objectives;

1. To describe the student-athletes of TAU in terms of the following;
   a. Sex;
   b. Age;
   c. Academic performance;
   d. Sports involvement; and
   e. Athletic performance.
2. to determine the school support given to student athletes.
3. to determine the after school activities of the student athletes.
4. to determine the relationship between after school activities and academic performance of the student-athletes.
5. to determine the relationship between after school activities and athletic performance of the student athletes.
6. to determine the relationship between athletic performance and academic performance of the student-athletes.

II. METHODOLOGY

This chapter presents the methods of the study, namely the research design, locale of the study, data gathering instruments, data gathering procedures and statistical tools to be used.

Research Design

The study will make use of the descriptive-correlational research design to find relationships of the following variables; school support, after school activities, academic performance and athletic performance of the Tarlac Agricultural University student-athletes. The descriptive will be employed in determining the school support and after school activities of the student-athletes. Correlational because it will determine the extent to which the school support, after school activities, academic performance and athletic performance correlates each other.

The study used Questionnaire Checklist to answer the specific problems of the study. It was be subjected to validation by experts and the suggestions and their suggestions were considered in the finalization of the checklist.

III. RESULTS AND DISCUSSIONS

This chapter presents the findings of the study which aimed to determine the effects and looked for the relationship of school support and after school activities of TAU student-athletes. It also presents the discussion and interpretation of the results of the analysis.

Table 1.*Profile of TAU Student-athletes*

	Monthly Allowance	**Clothing Allowance**	**Athletes Insurance**	**Training Allowance**	**Athletes Housing**	**Sports Development Program**
No. of Students	**0**	**55**	**0**	**55**	**0**	**6**
%	**0**	**100**	**0**	**100**	**0**	**10.90**

It can be gleaned on the table that there were25 females of the TAU student-athletes and 30 were all males. Furthermore, most of the athletes were at the age of 19-21 which indicates that they are still in the midst of their prime as student-athletes. Along their involvement in sports, most of them belong to theball games followed by athletics, martial arts, archery and swimming. With regards to their athletic performance, most of the student-athletes are middle performers; this was based on the number of athletes that 45 of them are middle performer out 55 respondents. This result indicates that the Tarlac Agricultural University (TAU) student-athletes need to perform better in their own respective sports discipline.

Table 2. School Support of TAU Student-Athletes

The table 2 presents the School support of Tarlac Agricultural University (TAU) student-athletes. It can be seen on the table that all the student-athletes receives clothing allowances in terms of competition uniforms and training allowances. But there were only 6 or 10.90 percent receives sports development in terms of their respective sports discipline. Furthermore, it was also found out that there is no housing, athlete insurance, and monthly allowance for all student-athletes in the university. This contradicts the study of Hartman & Kwauk (2011), on their study, "Sport and Development: An Overview, Critique, and Reconstruction", which states the generalpurpose is to show that practitioners interested in using sport for development however defined must acknowledge these theoretical issues and create appropriate programming if their intended outcomes are to be achieved.

Table 3. *After School Activities of Student-athletes*

Number of student-athletes (n = 55)	**Courses' requirements** (assignments, projects/outputs)	**Hanging out with friends**	**Hooked in multi-media platforms** (facebook, instagram)	**Still training for improvement**
F	**20**	**7**	**30**	**17**
%	**36.37**	**12.72**	**54.54**	**30.90**
Rank	**2**	**4**	**1**	**3**

In table 3, the after school activities of the student-athletes were presented. It shows that student-athletes hooked in multi-media platforms with 30 or 54.54 percent which rank first, followed by doing their courses' requirements with a frequency and percentage of 20 and 36.37 respectively, at rank third is still training for improvement which has a frequency and percentage of 17 or 30.90, while the last is hanging out with friends with a frequency of 7 or 12.72 percent. This only means that most of the student-athletes were hooked into multimedia platforms as their after school activities rather than doing their courses'

requirements or have their training after class to improve their capabilities. These findings were agreed to the findings of Fraser-Thomas in her study, "Youth Sports Programs: An Avenue to foster positive youth development", that the importance of sport programs built on developmental assets and appropriate setting features in bringing about the five C's of positive development (competence, confidence, character, connections, and compassion/caring.

Table 4. *Relationship between After School Activities to Academic Performance*

Variables (n = 55)	**Courses' requirements** (assignments, projects/outputs)	**Hanging out with friends**	**Hooked in multi-media platforms** (facebook, instagram)	**Still training for improvement**
Correlation Coefficient	0.004	-0.021	0.187	-0.220
Sig (2-tailed)	0.979	0.881	0.173	0.107

Legend: test at α = 0.05 level of significance

In the table 4 above, it shows that there is a significant relationship between the after school activities to the academic performance of student-athletes. It further shows that doing courses' requirements and hooked up in social media platforms has positive relationship while the hanging up with friends and training for improvement shows negative relationship to academic performance. This could only mean that doing courses' requirements and hooked up with multimedia platforms has an effect to the academic performance of the student-athletes. Thisis aligned with the study ofJames Bartlett Presbrey, (2017) on his study entitled "The Development and Sustainability of Sports-Based Youth Development Programs as a Viable Options for After-School Programs", whose findings states that after school programs have become a developmental for young people but the current social, political and economic climate continue to pose the following challenges: funding, program sustainability and expansion, quality improvement and maintenance and programming to meet the needs of an increasing diverse group of athletes.

Table 5. *Relationship between After School Activities to Athletic Performance*

Variables (n = 55) / **Athletic performance**	**Courses' requirements** (assignments, projects/outputs)	**Hanging out with friends**	**Hooked in multi-media platforms** (facebook, instagram)	**Still training for improvement**
Correlation Coefficient	**0.004**	**-0.144**	**0.065**	**0.033**
Sig (2-tailed)	**0.979**	**0.295**	**0.636**	**0.812**

Legend: test at α = 0.05 level of significance

The table 5 shows the relationship between the after school activities to athletic performance of the Tarlac Agricultural University (TAU) student-athletes. It shows that there is a significant relationship between after school activities to their athletic performance. Furthermore, doing courses' requirements, hooked in social media platform, and still training for improvement shows positive relationship to athletic performance and only

the hanging out with friends shows negative relationship. This could only mean that these factors will greatly affect the athletic performance of the student-athletes.

Table 6. *Relationship between Academic Performance to Athletic Performance*

Variable / **Academic Performance**	**Athletic Performance**
Correlation Coefficient	**-0.035**
Sig (2-tailed)	**0.799**

Legend: test at $\alpha = 0.05$ level of significance

The table 6 shows the relationship between the academic performance to athletic performance of the student-athletes of the Tarlac Agricultural University (TAU). It can be gleaned on the table that there is a significant relationship between the academic performance to the athletic performance of the student-athletes. The academic performance has slight effect on the athletic performance of the student-athletes

IV. CONCLUSION

Based on the findings of the study, the following conclusions were formulated:

1. Most of the student-athletes were middle performers and prefer ball games as their sports discipline.
2. School support is not adequate to maintain student-athletes in order for them to perform well.
3. Most of the student athletes were hooked up in social media rather than have their focus in doing their courses' requirements and training.
4. After school activities of student-athletes were significantly related to their academic performance.
5. After school activities and athletic performance of the student-athletes were significantly related.
6. The athletic performance and academic performance of the student athletes indicates relatedness.

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Modified Graph-theoretic Clustering Algorithm for Mining International Linkages of Philippine Higher Education Institutions

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***Abstract*—Graph-theoretic clustering either uses limited neighborhood or construction of a minimum spanning tree to aid the clustering process. The latter is challenged by the need to identify and consequently eliminate inconsistent edges to achieve final clusters, detect outliers and partition substantially. This work focused on mining the data of the International Linkages of Philippine Higher Education Institutions by employing a modified graph-theoretic clustering algorithm with which the Prim's Minimum Spanning Tree algorithm was used to construct a minimum spanning tree for the internationalization dataset infusing the properties of a small world network. Such properties are invoked by the computation of local clustering coefficient for the data elements in the limited neighborhood of data points established using the von Neumann Neighborhood. The overall result of the cluster validation using the Silhouette Index with a score of .69 indicates that there is an acceptable structure found in the clustering result – hence, a potential of the modified MST-based clustering algorithm. The Silhouette per cluster with .75 being the least score means that each cluster derived for r=5 by the von Neumann Neighborhood has a strong clustering structure.**

***Keywords*—MST-based clustering; Small World Network; von Neumann Neighborhood; internationalization; Prim's MST**

I. Introduction

Internationalization and partnership development undertakings pave way to establish identity in the international arena. As such, data in the field of internationalization as mirrored by students and international partnerships established by education institutions is growing to be a good interest of researches [1]–[4]. This is since the rate of internationalization increases with the unhindered channels of communications and affordable travel expenses. Universities seek to seize the opportunities from global partnerships and foster relationships with other organizations or institutions. Internationalization is also described to transform into mainstream strategy in higher educations and is increasingly seen as adding value to the life of universities through improving their quality [5]. The definition of internationalization being the process of integrating international, intercultural, or global dimensions into the purpose, functions or delivery of post-secondary education [6] is by common knowledge, the most frequently cited and widely accepted.

Meanwhile, methods and techniques in data mining allow analysis of very large datasets (i.e. big data) to extract and discover previously unknown structures and relations out of huge amount of details [7] for the purpose of knowledge extraction. As such, clustering in the data mining arena aims to establish high intra-cluster and low inter-cluster similarity in data. The high intra-cluster similarity should be based on the derived measurement from the data while the low inter-cluster similarity should maintain that elements in the different clusters should have maximum distance. These are intended to achieve beneficial knowledge from the data [8] for decision making and strategizing. Among different types of clustering, the most conventional distinction is whether the set of clusters is hierarchical or partitional [9] where hierarchical is a set of nested clusters while partitional clustering divides the set of data objects into non-overlapping clusters such that each object is in exactly a single cluster [10]. However in the real world, clusters come in arbitrary shapes, varied densities and unbalanced sizes that is why there is no universal clustering method which can deal with all problems [11].

Since most clustering algorithms' performance is affected by the shape and size of the detectable clusters [12], the requirement of an *a priori* knowledge about the actual number of clusters and the setting of a threshold to obtain adequate clustering results; a number of modifications to the clustering algorithms have emerged and are being explored to cope with said problems. Among which are graph-theoretic or graph-based clustering algorithms where data is represented in an undirected graph denoted as G={V,E} where the set of all data points is V and the set of connections between two distinct data objects (i.e. edges or links are contained in E. This is associated with a distance measure resulting to a connected subgraph or clusters. The use of Minimum Spanning Tree (MST) is one of said methods which either uses the Prim's [13]–[15] or Kruskal's [16], [17]. An MST is constructed for the whole data with a threshold value being set along with a number of steps to terminate the process to form clusters resulting from removing an inconsistent edge whose value is greater than the threshold value. However, this strategy is constrained by the identification and elimination of the inconsistent edge [17], detection of outliers [18], as well as insufficiently evidenced partitioning–hence, having the same weaknesses as other clustering methods that are based on distance measures [19].

This work aims to perform data mining in the data of the international linkages of Philippine Higher Education Institutions (PHEIs) using a proposed modified Prim's MST-based clustering algorithm producing a minimum spanning tree for the dataset infusing the computation of local clustering coefficient for the data points in the limited neighborhood generated by von Neumann Neighborhood.

This paper is organized as follows. Section II presents the conceptual framework of the modified Prim's MST-based clustering algorithm invoking the properties of the small-world network of graph theory. It also highlights the preparation of the International Linkages data. Section III includes the results of the simulation and the cluster validation. Section IV highlights the conclusions and future works of the study.

II. Modified Prim's MST-based Clustering Algorithm

Clustering can be used on many problems as it is helpful to seek and see relationships. It aims to congregate into clusters unlabeled data elements with high similarity based on a measure obtained solely from the data itself [20]. The distance measure defines the radius of membership depending on the type of data on hand. A good cluster is associated with high clustering value in terms of distance so the selection of distance metric is essential in clustering [21] while another clustering algorithm approach is to represent a target data set as a weighted undirected graph [20].

A. Prim's MST-based Clustering Algorithm

Prim's MST Algorithm uses a distance function to specify the closeness of data objects to establish the weight between them by choosing an arbitrary point to the next adjacent point of minimum weight. For clustering, an edge inconsistency measure is defined to identify an inconsistent edge to be removed to partition the whole dataset into clusters. Prim's MST is modified for efficient construction of spanning tree based on the k-nearest neighbor search mechanism during which a new edge weight is defined to maximize the intra-cluster similarity and minimize the inter-cluster similarity [13]. The algorithm can be used for a complete graph while using Fibonacci Heap [19], [22].

In this work, the traditional Prim's MST Algorithm for clustering defined by [18] as shown in Fig. 1 is modified by infusing the local neighborhood search by the von Neumann Neighborhood in order to facilitate the computation of the local clustering coefficients of the data elements in said neighborhood.

Higher clustering coefficient indicates the robustness on an average shortest path between any pair of nodes [23]–[25]. As such, small world networks [26] have the properties of having a small mean of shortest path length and high clustering coefficient. The Local Clustering Coefficient (LCC) quantifies the closeness of the neighbors of a vertex in becoming a clique. A concept in graph theory, LCC is basically computed as the number of triangles connected to a vertex over the number of triples around a given vertex. It is the probability that duos of neighbors of a vertex are connected by an immediate connection – the value is $0 \leq LCC \leq 1$. Thus,

$$LCC = \frac{number\ of\ connected\ neighbors}{number\ of\ neighbors} \quad (1)$$

Meanwhile, the von Neumann Neighborhood is one of the most commonly used types of neighborhood for cellular automata of two dimensions [27]. It is also used in pattern generation [28] and operations research [29] as it has been proven to have better performance than other topologies to further improve the quality of local search [30]. It can be extended by taking the set of data objects at Manhattan distance r where $r > 1$ which yields a result of a diamond-shaped region – hence, the neighborhood of data objects. The two-dimensional square lattice is composed of the central cell and the four adjacent cells around achieved through traversing North, East, West and South (NEWS) derived at a Manhattan distance 1. The number of neighbors (i.e. cells) in 2-dimensional by von Neumann Neighborhood of the cellular evolutionary algorithm for range r is defined as:

$$2r(r+1)+1 \quad (2)$$

As such, the modified Prim's MST-based Clustering Algorithm establishes the adjacency of the data facilitated by the suitable cellular automaton, the von Neumann Neighborhood which simulates the establishment of neighborhood. This preludes the computation of local efficiency or local clustering coefficient. Thus, the modified Prim's MST construction for clustering is defined by (u, v, LCC(v), d(u,v)) such that u is the initial data point and v is the terminal data point.

While the traditional Prim's MST considers only the next minimum distance d(u,v) between data u in the MST being built T and the adjacent data point v in V; the modified algorithm initially considers the LCC of the adjacent data point LCC(v) to ensure a high clustering coefficient for the whole cluster – hence, pursuing clusters of density. As Prim grows the MST one edge at a time, it should be noted that the next candidate edge or connection of data point must respect the partition or cut of the set of points in the minimum spanning tree T and V to avoid having a cycle.

Pseudocode for PMST for Clustering

```
procedure MST Clustering (V: set of data points v )
construct a fully connected graph G of V such that
the
   edge weights are the distances between data
points
construct  Prim's minimum spanning tree T of G
maintain disjoint sets V and T
select minimum d(v,u) where v∈VT and u∈V
check for cycle
find all inconsistent edges of T
remove inconsistent edges to get a set of connected
    components
define the connected components as clusters
```

Fig. 1. Prim's Minimum Spanning Tree for Clustering.

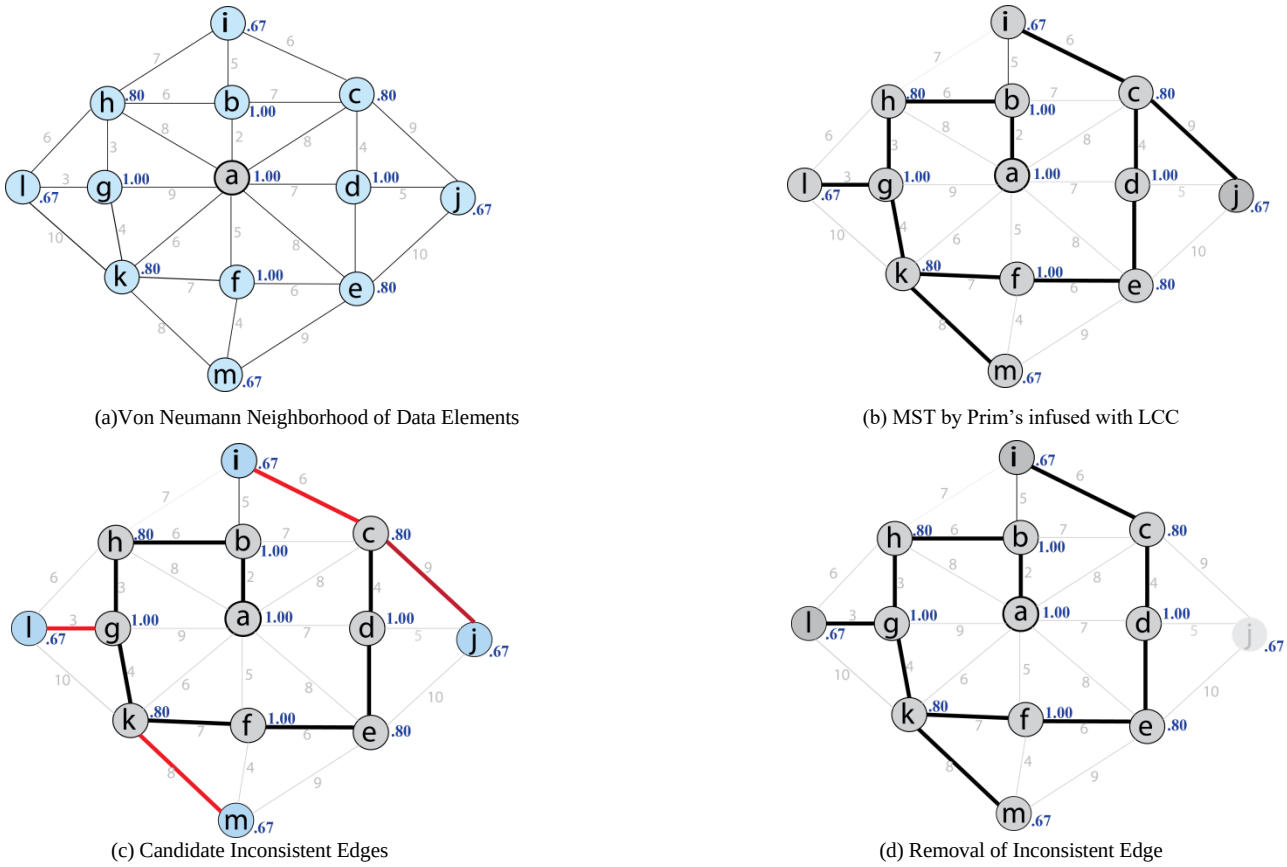

Fig. 2. Prim's Minmum Spanning Tree Construction for a Local Neighborhood Established using Von Neumann.

Being the data element having the least LCC(v) and maximum distance d is the criterion set for identifying the inconsistent edge. Data elements l, j, k and m in Fig. 2(a) are all LCC=.67 – hence, their distances to the data points in the MST were considered as indicated in Fig. 2(b). As such, d(c,j)=9 indicated in Fig. 2(c) as the connection with the greatest distance is the inconsistent edge. The algorithm will herein iterate and continue on the other data points of the data set. The resulting MST must have N-1 edges for N number of data points without cycle – hence, the cluster as seen in Fig. 2(d).

B. Data Cleaning and Preparation

The PHEI International Linkages data contains the actual and essential records for the international linkages of Philippine Higher Education Institutions. It is consist of partnerships entered by PHEIs with foreign universities and/or organizations transpiring into different internationalization activities including student exchange, faculty exchange, academic collaboration, research collaboration and other activities across different disciplines. The dataset is summarized in Table I.

An integral part of the data mining process is the data to which knowledge discovery is applied. The International Linkages data contains instances of inconsistencies, incompleteness and variations in the essence of data mining. As such, entries or values were simplified and prepared such that the proposed algorithm is able to process it. In the original data, the field for partnership form has duplicative entries and no defined options. A particular discipline is mentioned in several groups with each specific to a particular partnership. A similar case can be observed with an area of partnership (e.g. Faculty Exchange) being included and specific in a number of partnerships. Hence, in Table II are the disintegrated attributes rooted from the form of linkages attribute of the original data.

TABLE I. LIST OF PHEI LINKAGES DATASET FEATURES AND DESCRIPTION

Name	***Definition***	***Example***
country	where foreign university or organization partnered is located	Indonesia
continent	where country of foreign university or organization partnered is located	Asia
phei	the Philippine Higher Education Institution (e.g. SUC, HEI)	TAU
partner	name foreign university or organization partnered	CRRU
p_form	form of partnership	Bilateral
p_area	area of internationalization activities	Faculty Exchange
p_discipline	field of discipline covered by the partnership	Education
d_signed	date when partnership was signed	02/06
p_year	year when partnership was signed	2017
p_status	if active or inactive	Active

TABLE II. CONTENT RELATED FEATURE OF ATTRIBUTES DISINTEGRATED FROM FIELD

Name	***Definition***
p_type	Bilateral; Multilateral
p_area	Faculty Exchange; Student Exchange; Research(er) Exchange/Collaboration; Academic Collaboration; Joint Publication
p_discipline	Accounting, Arts, Education, Fashion and Textiles, Social Studies

The conversion of the textual values was necessary since most instances are texts and multiple values are specific to one entry. The data cleaning and preparation executed is where each distinct group is coded. For instance, in the area of partnership terms, the PHEI can either use its own nomenclature but certainly, it may also use the terms of reference by the prospect foreign partner university or organization. Hence, all attributes were coded and assigned a numerical value to discretize the data so that the clustering algorithm will be able to process it.

III. RESULTS AND DISCUSSION

The cluster analysis of the data on international linkages of PHEIs aimed to gain valuable insights of the data to see what groups the data elements belong to while having the modified clustering algorithm to define instances with similar properties as a group. Data may come into mix type in the real world such that one attribute may be expressed in ration and others in terms of categorical that adjustment may be hard in terms of the algorithm because some specific algorithms can only be applicable to certain types of data. There may be a need for some data transformation or preprocessing to do so that the algorithm will work. Data cleaning and preprocessing was an integral part of the data mining process to make adjustments and the data be made suitable with the proposed algorithm as it cleaned and prepared the data for the algorithm to be able to process it.

A. Simulation

The algorithm was implemented through the following Pseudocode in Fig. 3 and simulated on the discretized Internationalization data set.

```
Pseudocode for Modified Prim's MST-based Clustering with
Local Efficiency

procedure MST Clustering (V: set of data points v )
Remove all redundant data
set arbitrary data point
get arbitrary data point's Neighborhood
generate connection for each data point in neighborhood;
set LCC for each data point in neighborhood
construct  Prim's minimum spanning tree T of G
maintain disjoint sets V and T
set data point with least LCC and maximum distance as
    inconsistent edge
remove inconsistent edges to get a set of connected
    components
define the connected components as clusters
```

Fig. 3. Modified Prim's MST-based Clustering with Local Efficiency.

The International Linkages data set is composed of 12 attributes with 748 instances. With a random value r=5, seven clusters were generated. The attributes with only at most 2 possible values were not used for the experiment.

Two attributes (e.g. continent, phei) were used to define an instance-hence to illustrate, data point (x, y) defines one data element by its value on attributes continent and phei as x and y, respectively. The neighborhood of said data points determined by NEWS was derived with the nearest higher value in x for north, nearest lower value in x for south, nearest higher value in y for east, and nearest lower value in y for south until the prescribed number of neighbors of the arbitrarily chosen value through von Neumann's Neighborhood is derived.

An observation on the result of the presented data mining procedure is that the generation of edge or connection between the data points to form the neighborhood impacts the processing time of the algorithm. The complexity of this part of the modified algorithm is also challenged when the data points are not linear. The choice of value for r also is also critical as a minimum choice will produce more clusters which impact the inter-cluster separation.

B. Cluster Validation

As there is no optimal clustering algorithm [31], it is necessary to evaluate the generated clusters of the mining process on the International Data. One approach is an internal validation with which the concentration is the partitioned data such that the compactness and separation of the clusters are measured. The Silhouette index [32] is where the silhouettes show which objects lie well within their partition and which are somewhere between clusters. The silhouettes herein were formed basically by knowing the clusters or partitions generated by the modified clustering algorithm and the distance between the data points–hence, a data point i's distance to other points within the cluster it belongs to and to other data points in other clusters.

The average distance a(i) of a data point i to all other objects in the cluster it belongs to is computed in the same manner that the average distance b(i) to other objects in other clusters is also derived. Hence, the silhouette score is derived as:

$$s(i) = \frac{b(i)-a(i)}{\max\{a(i),b(i)} \quad (3)$$

The Silhouette index is chosen for the validation of the resulting clusters of the proposed graph-theoretic clustering algorithm in order to observe how well the algorithm partitioned the data set [33]. The focus is also on the quality of the clustering structure being measured only using information or feature intrinsic to the data set [34]. Another salient point in choosing the Silhouette index for cluster validity is because it measures attributes taken from the data, itself and the clusters found [35]. The silhouette scores ranging from -1 <= s(i) <= 1 can be interpreted in Table III.

The validation on the clustering result generated by the modified graph-theoretic clustering algorithm infused with small-world network structure based on the Silhouette score is presented in Table IV which presents the silhouette score of the clustering result. The average intra-cluster distance was derived

from calculating the distance of a random point (x, y) in a cluster towards all other data points in the same cluster to which it belongs to. Inter-cluster distance is the distance of this (x, y) towards the other data points in other clusters.

TABLE III. SILHOUETTE SCORE INTERPRETATION

Range	***Description***	***Interpretation***
0.71 – 1.00	Strong	A strong structure has been found.
0.51 – 0.70	Reasonable	Reasonable structure has been found.
0.26 – 0.50	Weak	Structure is weak and could be artificial.
≤ 0.25	Not Substantial	No substantial structure has been found.

TABLE IV. SILHOUTTE VALIDATION ON CLUSTERING RESULT

Cluster ID	***Average Intra-Cluster Distance***	***Average Inter-Cluster Distance***	***Silhouette Score***
1	2.57	14.65	0.81
2	2.46	9.65	0.75
3	3.09	15.82	0.80
4	3.20	19.83	0.84
5	2.86	16.64	0.83
6	2.70	15.82	0.83
7	-	15.11	0.00

The average Silhouette score derived as 0.69 indicates an acceptable structure was found which is also manifested in the scores of all the clusters which derived scores not lower than 0.75 which means that each cluster has a strong structure except for Cluster 7 which has only one (1) data point – hence, silhouette score is 0. Such constraint is present to prevent the number of groups from significantly increasing [36]. Consequently, when a clustering result is interpreted based on Table III, the clustering is acceptable when the score is at least 0.50 [37].

IV. CONCLUSION

This work performed data mining in the international linkages of Philippine Higher Education Institutions (PHEIs) data using a proposed modified Prim's MST-based clustering algorithm producing a minimum spanning tree for the data set infusing the computation of local clustering coefficient for the data points in the limited neighborhood generated by von Neumann's Neighborhood.

An integral part of this work was the preparation of the raw data to achieve the dataset that is ready for processing by the modified Prim's MST-based clustering algorithm. The numerical attributes of the International Linkages dataset were used for the clustering to work on similarity on a particular parameter.

The results of the study show that there is an acceptable structure found in the clustering result with silhouette score 0.69 and 0.75 being the least score for the 6 out of 7 clusters derived for r=5 of the von Neumann Neighborhood.

However, the algorithm is still bound by the *a priori* input value of r which dictates the number of possible neighbors in one cluster for the von Neumann Neighborhood. As such the optimum number of clusters and most ideal value of r for a particular size of data are interesting.

Also for future works, the interest is also centered on the cluster validation utilizing external validity indices particularly those which works or are specific to graph-theoretic clustering algorithms. The data can also be refined more and subjected to clustering process to compare the performance of the traditional and the modified clustering algorithm.

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Towards a Bespoke Document Tracking System for Philippine Higher Educational Institutions

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Abstract*: This study on the development and validation of a document tracking model for utilization of Philippine Higher Education Institutions was undertaken to produce a system that would facilitate the management of documents in state universities or colleges by providing a way to monitor, record and track the location of in-process documents to support an academic organization. The Software Development Process was used as basis for the development of the software involving phases such as user requirements specification, design and implementation, validation and evolution (i.e. the process of changing or modifying the system once it has gone validation and yielded feedbacks for further modification). The acceptability of the software as evaluated by forty (40) office personnel representing every units of the Tarlac Agricultural University – the sample locale of the study, was confirmed in terms of user interface and functionality. These evaluators judged the software based on their skills and ability to use the software while carrying out their job functions. Five (5) IT experts also judged the software in terms of user interface, functionality, database design and security. Based on the results of the study, findings indicate that the document tracking system is excellent for the evaluators as process owners with a grand mean of 4.54 with its ease of use because of the simplicity of operations and the design itself with the reliability and usability or fitness for purpose as to tracking in-process documents and generating reports. The experts also evaluated the system as excellent with a grand mean of 4.58 – hence, the system's visual, functional and navigational elements and the manner it requests information helps the user operate the document tracker. Security was also judged as excellent because the system can control users and produce integral records.

***Index Terms*: document tracking, information system, transaction processing system**

I. INTRODUCTION

Bureaucracy is expected in most countries and most often than not, it had caused much effect in anyone's perspective of efficiency and effectiveness. In the Philippines, government agencies now are always under the watchful eye of the discerning public. They are always trying to become more efficient and effective in their delivery of services, primarily because they owe the public. The Republic Act 9465 or the Anti Red-tape Act has been issued which states that government transaction such as applications or renewal of permits, licenses and other documentation should be completed in five working days especially for simple cases and 10 working days for more complex transactions or requests.

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It said that each agency is also required to reply to the client, whether requests are rejected or couldn't be processed with the explanations why it was rejected and what could be done to re-file their requests. Signatories in each document, the law states, must be limited to a maximum of five persons to reduce time and simplify procedures. As such, many perceive information and communications technology as a cost effective and convenient means to promote openness and comprehensive transparency efforts in most countries [1]. Information Systems are being employed and implemented to reflect improvement and efficiency as well as becoming at pace with the influx of technology. The trend nowadays is to include less paper and manpower in the organization's or institution's operation. Yet, although computer generated electronic records have been around, the phenomenon of a paperless office is still remote although paper consumption puts substantial pressure on today's world forest ecosystem where it seems on the face of it that emergence of computer and capacity of storage of documents in electronic form may lead to decrease in consuming such – hence, emergence of the paperless office [2]Apparently, any business organization or even an education institution still relies on standard operating procedures which primarily include pertinent documents and communications which do need to be managed efficiently and effectively in a manner that they can be tracked down or monitored. Even academic institutions such as the Tarlac Agricultural University boast their transparency of rendering services to their clientele, employees, office units and external community. It caters to the needs of its stakeholders via standard procedures which include or involve processing or pertinent documents. Management of 'in-process' documents would serve as a breakthrough in the manual operation of managing document's passing through the offices to minimize the problems encountered in following-up, tracking down and monitoring documents throughout the University – thus, a Document Tracking System. A document tracking assumes that knowing the movement of a document would enable a decision-maker to pinpoint where it is and in what state – thus, receiving, immediate feedback to make timely and rational decisions. It is a means for monitoring a document's movement from "birth" to "growth" to "death" and in some cases, to "rebirth." In relation to proper management process, this concept of record lifecycle sees records as passing through various stages: creation, active use, inactive use and then onward to either destruction or rebirth in the form of archives.

Another variation of document tracking is video based where the tracking of paper documents is on the desk over time and automatically linking them to the corresponding electronic documents using an overhead camera [3].

As such, DTS is a type of information system that handles the task of recording and monitoring in-process documents. Concerned with 'moving' documents, attributes of the document are captured into the system and not the document itself – profile of the object [4]. Having, this, a document tracking system when being developed needs to be in accordance with the type of business or organization or for this case, educational institution for which it is being developed for.

This is because of their uniqueness in business processes or the ways documents are handled or passed through.

The university observes manual taking note or records of documents and communications via "the logbook" monitoring or the "received by" and "released by" on a certain date system. Since computerized systems are necessities in an organization's way of accomplishing transactions and processes, the rate of adoption of electronic alternative over the past years and the dominance of paper over digitized records also justify the conduct of this work to facilitate the in-process documents' management of TAU as a Philippine Higher Education Institution.

This study aimed to develop and validate a Document Tracking System (DTS) for the University which will facilitate the movement of documents from one unit or office to another in the University and keep track of the whereabouts of these documents in process.

This paper is organized as follows. Section II presents the review of related literature. Section III focuses on the work's methodology followed by the presentation, analysis and interpretation of results of the study in Section IV. The Section V summarizes and concludes the paper and some future works.

II. METHODOLOGY

A document is an identifiable recording of information and any recording medium can be used as long as it persists over time. Information is more than the data. So a document includes some elements of contextualization, organization and analysis and even if one's job is just the management of documents for some specific corporate purpose, it is a professional responsibility to know the relationship of those documents to the society [5].

The most important factor for the success of this project was how closely the particular plan was defined and followed. In order to at least be as close to achieving such, this study was defined with a schedule to follow for its development from its birth and eventually to full development, towards the in-depth analysis of the possible processes that it could offer as features to solve the problems encountered in the current 'in-process' document management of the University. The development was guided by the Concept of Software Development Process with fundamental activities, namely: Specification, Design and Implementation, Validation and finally, Evolution. The "evolution" in this study was the idea of correcting the errors based on feedbacks of the validation phase.

A. Data Gathering Procedure

In order to analyze the performance of the proposed Document Tracking System, there is a need for appropriate materials or instruments to collect pertinent data. Observations, interviews and questionnaires are the most appropriate for this purpose in this study. During this study, the observation took charge on investigating the available facts and data to obtain specific objectives. The researcher eyed the process or tasks involved in university's document management.

Interviews were also employed to facilitate the acquiring of the pertinent and supplementary data that may not have been gathered during the observation. These data primarily were specific on the parts of a Document Tracking System namely: the people (operator, management), equipment (computer, printer, barcode readers), data (from the documents), tools, space (office units), and procedures. The questionnaire was used to gather information and opinions from the end-users of the proposed-systems. The respondents of this questionnaire were given a background of the proposed system or actually were allowed to experience the proposed system's design.

B. Development Tools

The system was developed utilizing MySQL, an open source Database server and a relational database management system that works in client/server or embedded systems. MySQL, the most popular Open Source SQL database management system, is developed, distributed, and supported by MySQLAB. The choice was for its main features of including portability, security, and scalability. PHP was used as the Web Development language - a server-side scripting language, which can be embedded in HTML or used as a standalone binary. This scripting language includes features such as it is free, easy to use, HTML-embedded, none-tag based, stability, speed, extension to other programs and protocols, fast feature development, popularity and non-proprietary. With these, the system was made more stable as it was developed as a web-based system.

C. Software Validation

To determine the efficiency of the developed software, the following scale was used by the IT experts and users in rating the system. To determine the adequacy of scope and user-friendliness of the developed software, the users used the scale presented in Table 1. This ensured that the true requirements of the system were yielded by exposing it to potential end-users.

Table 1. Scale used in Evaluating the System

Units of Indexes	Adjective Description
4.50 – 5.00	Excellent
3.50 – 4.49	Very Satisfactory
2.50 – 3.49	Satisfactory
1.50 – 2.49	Poor
0 – 1.49	Very Poor

III. RESULTS AND DISCUSSION

A. The Existing System

The flow of operations of the existing system of managing in-process document in the university is depicted in the Figure 1. It clearly depicts that some activities in the process of recording the in-process documents are repetitive in a way that clerks who are in–charged as receiving and releasing officers repetitively record or note about their incoming and outgoing documents. The dataflow diagram of the existing system in Figure 1 indicates that documents do not have in any way a unique identification of itself in the process which may be used in tracking it. This is because the same single document can be recorded differently by the different releasing and receiving officers with the aforementioned procedure.

There is no definite way to track or search the document or worse, to know the document's location. To hunt the document through the log books is a complex process since one would have to look into receiving and/or releasing logbooks of every office where the document may have passed. Added to the burden would be on searching more specifically for a document on the notes recorded on the logbook. The process boils down to looking onto logbooks after logbooks and records after records.

Figure 1. Dataflow Diagram of Existing Document Management of In-Process Documents

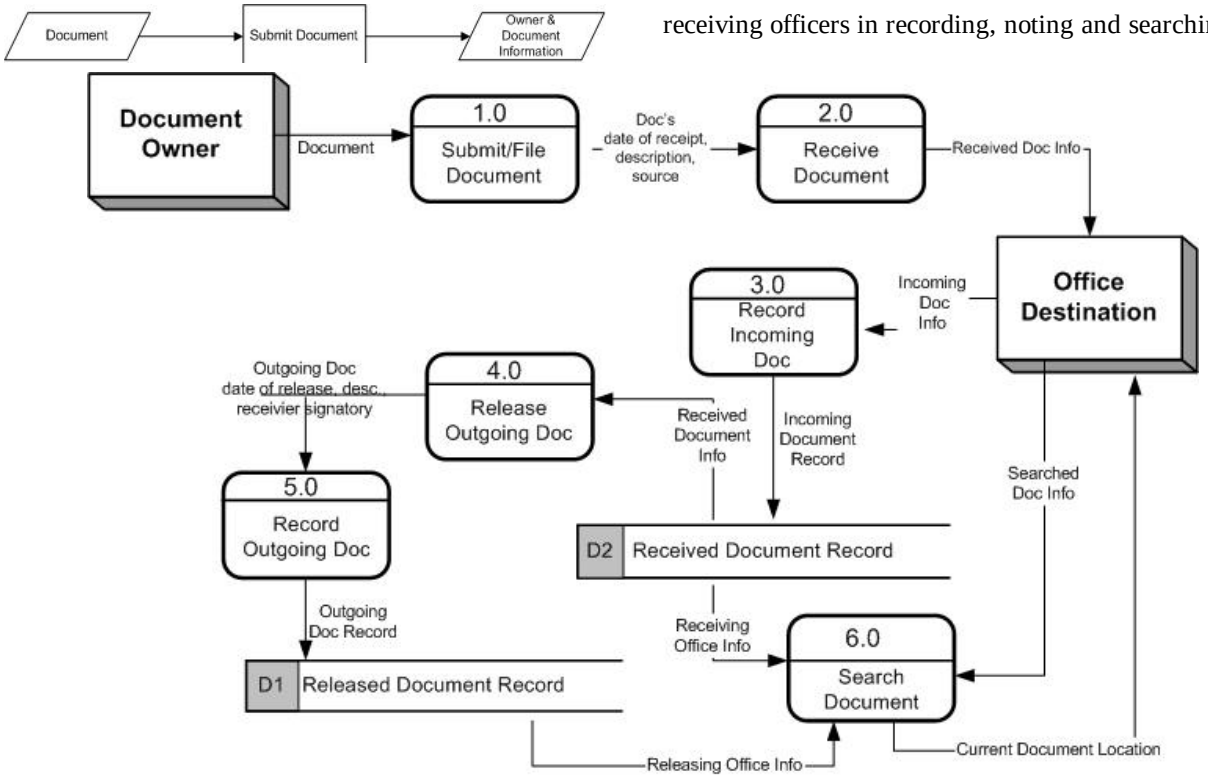

Figure 2. Input-Process-Output of Document Tracking

The releasing and receiving officers in an office in the units are not always the clerk. The existing process does not have means to record who may have released or received the document so that when time comes that a document being searched or tracked down is identified to be last received in an office, another question would be who received it.

B. Design and Implementation

After careful analysis of the existing system based on gathered facts, the researcher was able to develop the following one or more different system models and prototypes to depict the proposed system's flow of operations.

Figure 2 shows the process involved in the proposed system which actually depicts the flow of operations of the document tracking process using the proposed system.

The creation of an office account and generation of barcode is the definite difference of the existing system and the proposed Document Tracking System.

The process of generating a barcode plays a significant role in the tracking or searching of the document. It is the unique identity to be used by the document owner, releasing and receiving officers in recording, noting and searching for the document's current location.

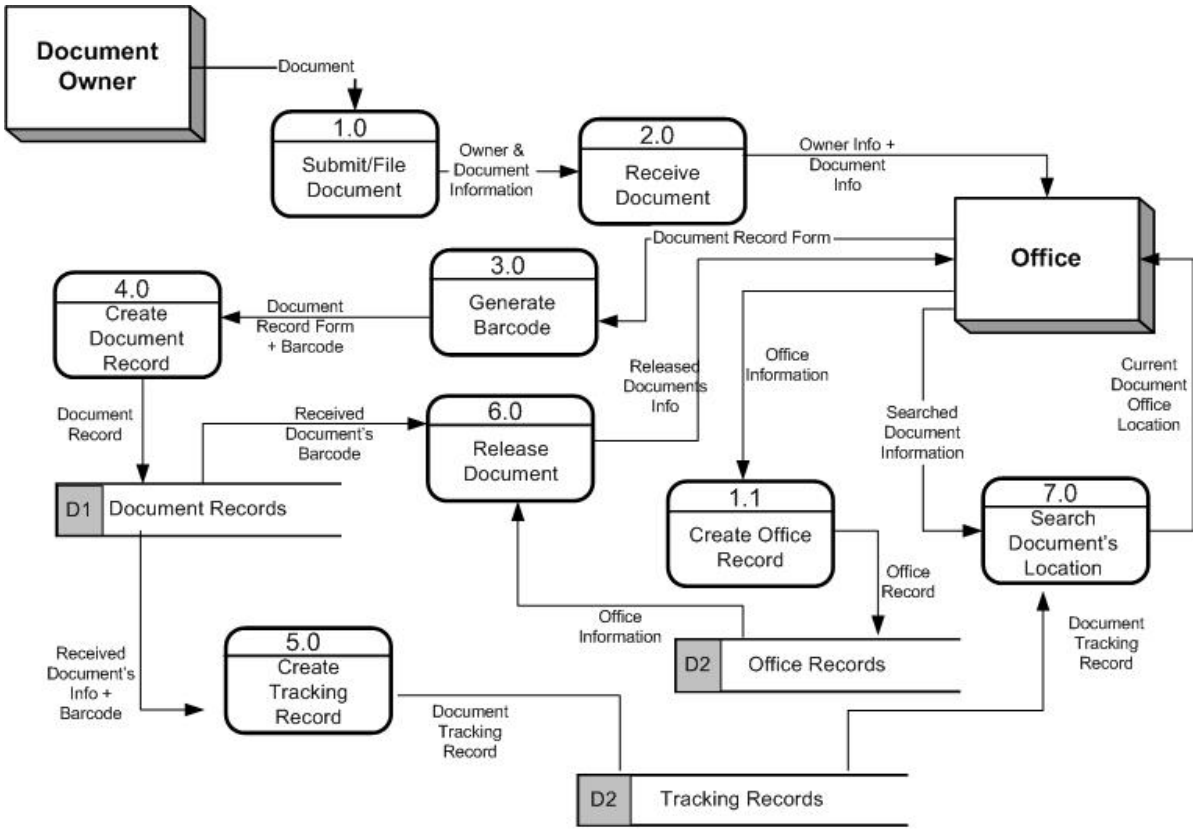

Figure 3. Dataflow Diagram of Document Tracking System for In-Process Documents

Once a document is received by an office, the document's record is created to note its owner and to generate a barcode image which will serve as its identification. This process only happens once for a document and only at the first receiving office. Using the document's id, the receiving office shall then be tagged – using the barcode reader to recognize the printed barcode id – to signify that the document was received by the office. This replaces the process of having to incoming document over and over again from one office to another. The barcode id shall also be used to tag the release of the document by the office.

The dataflow diagram in Figure 3 depicts the flow of data from one process towards the next. It also emphasizes the destination and origin of services and information during the document tracking process. As an information system being defined by a well-organized database structure that will

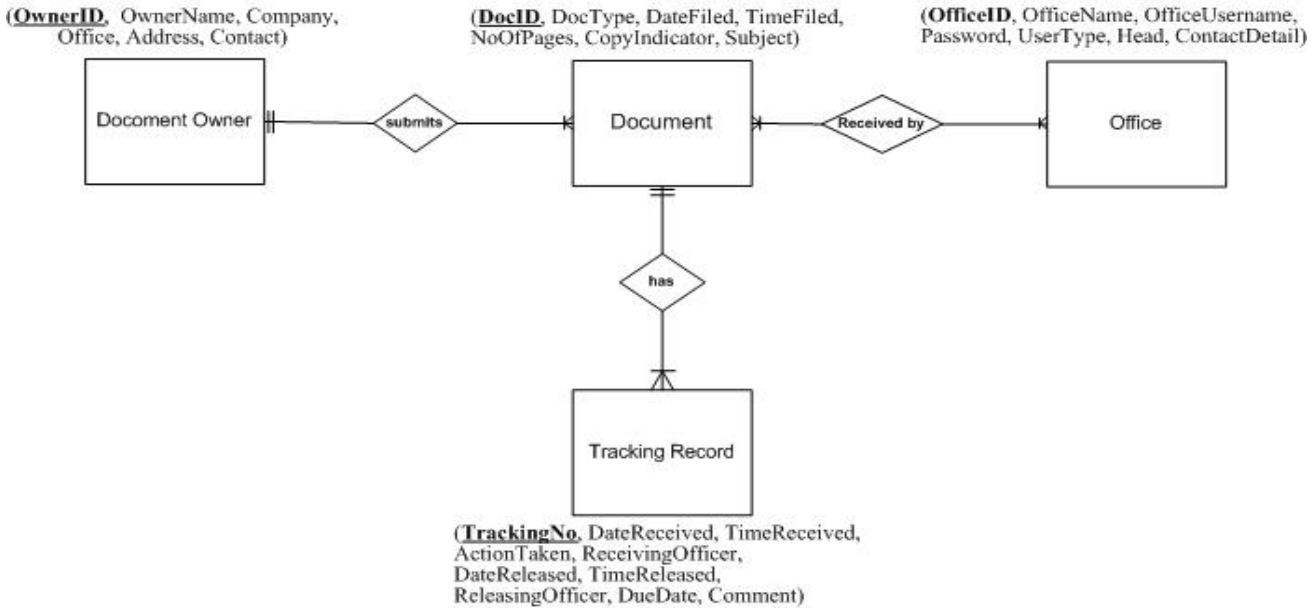

Figure 4. Entity Relationship Diagram of the Document Tracking System.

record an

handle the entry of data into the system and how it will generate necessary reports, the entity relationship diagram in Figure 3 displays how the back-end of the proposed system was designed to hold the information that shall enter the system.

The database was designed to be centralized mainly for the database's maintainability. Since the document tracking system emphasizes on how timely records or information are synchronized for them to be available to user, the database was designed to a centralized database as back-end. Figure 4 displays the Entity Relationship Diagram of the Document Tracking System.

The synchronization of records or information is critical in the tracking feature of the online document tracking system since an update in records in one office should be immediately recognized by another by any chance of dealing with same document that is being processed or reports being produced.

A tracking record is created once a document is received by an office either from another office or from the owner himself. The tracking records table is the main table of the database for it is from which that the current location or the last receiver can be identified. The fields with which the tracking record contains no DateReleased, TimeReleased and ReleasingOfficer clearly indicates that the office to which this document's tracking records was created is the document's current location.

Figure 5. Barcode of a Document

As seen in Figure 5, a user can print a document's barcode ID in the physical document itself or on a sticker and recognize it also to produce reports out of said information primarily to track the document itself.

C. Validation Results

Five Information Technology experts of proven expertise in web applications development and management were tapped to judge the Document Tracking System. Their comments and suggestions were considered in the improvement of the system.

The experts were composed of one net administrator, two web developers and one systems administrator from government institutions namely: Central Luzon State University (CLSU), and the target itself, TAU. One web developer coming from the Manila-based Global Property Guide, a private company, also evaluated the system. All of them are highly qualified in evaluating the system because of their familiarity with web applications and administration. The questionnaire for the evaluation was based on the criteria specified in the statement of objective of this study. Table 2 indicates the experts' evaluation on the user interface.

Table 2. Experts Evaluation of User Interface

Software Evaluation Criteria		Average	Descriptive Rating
A. User Interface **(Composite Mean : 4.52)**			
A.1	Visual Appearance	**4.40**	Very Satisfactory
A.2	Appropriateness of design	**4.40**	Very Satisfactory
A.3	Navigational elements	**4.60**	Excellent
A.4	Request for information	**4.60**	Excellent
A.5	Functionality of barcode reader	**4.60**	Excellent

The IT experts came up with the aforementioned rating by assessing the Document Tracking Systems interfaces, online. The system was accessed on http://doctrack.tca.edu.ph on a terminal owned by the IT expert evaluator as assisted by the researcher or the web administrator of the College.

Table 3. Experts Evaluation of Database Design

Software Evaluation Criteria		Average	Descriptive Rating
B. Database Design **(Composite Mean : 4.60)**			
B. 1	Arrangement of data	**4.60**	Excellent
B. 2	Synchronization of database	**4.60**	Excellent
B. 3	Logical Design	**4.60**	Excellent

The tracking records generated by the Track Document feature of the system indicate how the data were arranged in the system and how they are presented as evaluated by the IT experts with which result of evaluation is indicated in Table 3.

Table 4. Experts Evaluation of Security

Software Evaluation Criteria		Average	Descriptive Rating
C. Security **(Composite Mean : 4.60)**			
C. 1	Authorization of User	**4.60**	Excellent
C. 2	Implementation of user permissions	**4.60**	Excellent
C. 3	Integrity of records	**4.60**	Excellent

An indication of security noted by the IT experts as indicated in Table 4, during the evaluation was the difference on the permissions of a regular office account and that of an administrator account.

The results of the IT expert's evaluation came up with an over-all mean of 4.58, interpreted *Excellent* based on the scale used. It consists of the composite means of 4.52 for user interface, 4.60 for functionality, 4.60 for database design and 4.60 for security. Meanwhile, the researcher submitted the system for evaluation to end-users such as clerks, office personnel, as well as

on-the-job trainees and student assistants in the office/units since they also take charge in recording the incoming and outgoing documents of their offices. One representative from the forty offices in the university was tapped to evaluate the system purposively including students who also submit reports/documents to the offices as part of student organizations such as student publications and student councils.

The result on their evaluation on the ease of using the system is indicated in Table 5.

Table 5. Users Evaluation on Ease of Use

Software Evaluation Criteria		Average	Descriptive Rating
A. Ease of Use **(Composite Mean: 4.54)**			
A.1	Simplicity of Design	4.55	Excellent
A.2	Simplicity of Operation	4.53	Excellent

Some of user evaluators also gave their comments which were considered by the researcher in further improving the design in order to meet the end-users' requirement to the system. The Record's Office head was made to evaluate the system using the Administrator account while the rest of the offices were given their own individual office accounts with username and password. The Document Tracking System was uploaded online for this purpose. The users were provided their own accounts per office and oriented on how to use the system. The questionnaires were handed on them and was made to reply on their own initiative on whether their experience of the system is already enough to give it their ratings. Table 6 also shows the users evaluation on Usability.

Table 6. Users Evaluation on Usability

Software Evaluation Criteria		Average	Descriptive Rating
B. Usability (**Composite Mean: 4.58**)			
B.1	Keeping track of incoming documents	4.70	Excellent
B.2	Keeping track of outgoing documents	4.65	Excellent
B.3	Tracking in-process documents	4.65	Excellent
B.4	Generating reports	4.65	Excellent

The use of the barcode scanner to read the barcode document ID was demonstrated to the user evaluator when tracking the document, receiving the document and also in releasing the document. Users gave positive feedback on said process because it eliminated the tedious repetition of recording the incoming and outgoing documents from office to office and from logbooks to logbooks.

The *receive document* feature of the Document Tracking System affirms the elimination of repeatedly recording received documents in all offices. The idea of a document being recorded as received on all offices and traveled is replaced by the action of just tagging the document through scanning the barcode document ID.

Table 7. Users' Evaluation on Reliability

Software Evaluation Criteria		Average	Descriptive Rating
C. Reliability (**Composite Mean: 4.51**)			
C.1	Response to user actions	4.48	Very Satisfactory
C.2	Message Prompts	4.48	Very Satisfactory
C.3	Reports Generation	4.58	Excellent
C.4	Management/presentation of outputs or reports	4.50	Excellent

Reliability of the system as evaluated by the users which results are indicated in Table 7 and the IT experts connotes similar idea. It defines whether the users are being presented with reports that can be used officially by the system.

Reliability was also interpreted by the users whether it prompts messages or gave appropriate response to their actions as well as how the outputs or reports are presented. The results of the users' evaluation were a composite mean of 4.54 for ease of use, 4.58 for usability, and 4.51 for reliability. Over-all, the system obtained a mean of 4.54.

IV. CONCLUSION

The Document Tracking System developed as a bespoke model for Philippine State Universities and Colleges was developed based on the Software Development Process activities. The IT experts gave a positive feedback on the user interface, functionality, database design and security with a grand mean of 4.58 or excellent. The acceptability of the software was evaluated by end-users as to ease of use, usability and reliability and a positive response based on the aforementioned criteria was derived with a grand mean of 4.54 – hence, excellent. The range of values of the results of evaluation of the system shows that the evaluators judged the system highly acceptable in the provisions for enough dry run, in the statement of the desired validation outcomes, and in the usefulness and performance of Document Tracking System. This turns out to agree with the result of the studies cited in the related studies, specifically [4] which highlighted the underlying factors in the development and employment of a document tracking system which helped out in the development of the Document Tracking System.

For future work, the document records will be studied for purpose of data mining to optimize the features of tracking in-process documents. Also, the system is planned to be integrated on the University-wide document management system which also needs to be integrated with the information systems which depend on document and information retrieval.

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AUTHORS PROFILE

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