Creating Analysis Class Diagram in UML by Using Picture Story

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Abstract— The creation of an analysis model using Picture Story has a long development history. It may have started from the Context Diagram of Structured Analysis, which was invented by Tom DeMacro in 1970. This was followed by Use Case Diagram, invented by Ivar Jacobson, which was joined with UML in 1995, and an Agile User Story, used to catch the functional requirements of the system. Many researchers have tried to conduct research on the requirement functionality of the system by using a Mind Map or difference tools. In this research, the researcher developed a simple methodology called a Picture Story. This tool to assess the functionality of the system and to create an analysis model using Picture Story and based on human relationships. Then the researcher developed a classical ATM case study; to try out with the second-year computer science students, the Faculty of Applied Science, King Mongkut's University of Technology in North Bangkok. The sample size of 70 students, since the researcher did not classify the group of students, the additional data scores of Object-Oriented Programming (OOP) were collected. The Partial Correlation was used to compute the relationship between Scenario and Picture Story while OOP was eliminated. The partial correlation equal to 0.82 and the t-test pair was used to compare the mean between the Scenario and the Picture Story. The mean of Scenario was 9.26, with an SD equal to 5.15 and the mean of the Picture Story was 38.22. The SD was equal to 11.12. The paired t-test of Scenario and Picture Story equalled 21.37 and the p-value for one-tailed was 0.0019; therefore, students claimed that using Picture Story was better than using Scenario in Analysis Class.

Keywords: Analysis Model; UML; Scenario; Storyboard; Concept Mapping

I. INTRODUCTION

Nowadays, in terms of system development, one of the most important aspects is understanding the needs of the users. Then, system analysts must write about one to two pages on Scenarios, System Specifications, Use Case Diagrams, Activity Diagrams, Sequence Diagrams, Analysis Classes, and State Chart Diagrams. The creation of an Analysis Class can be achieved in a variety of ways, such as underlining the scenario, drawing a picture story, using a mind map etc. In this study, the researcher focused on the creation and comparison of Analysis Class and its relationship with Scenario and Picture Story. This research was preceded by an ATM case study with seventy computer science students in the Faculty of Applied Sciences at King Mongkut's University of Technology, North Bangkok in the 2016 academic year.

II. RELATED LITERATURE

A. Conceptual Chart

A conceptual map is a mapping tool, also known as Concept Mapping. It is a popular visualization and thinking technique that uses a variety of pictures. This is especially true when applied in classrooms in the international context. There is a similar term, Mind Mapping, which involves a Mind Scape or a three-dimensional mind map or three tools related by their overlapping parts. The three tools include the mental model, which are visible or tangible as well as manageable.

Concept Maps can be used to represent the conceptual structure of a subject in a two-dimensional form and represents the conceptual representation of a meaningful

relationship between concepts. It could be the variety in the form of a text or it may be a two-label idea. It comes in a combination of words that express the relationship between the concept and the line that connects relationships and ideas-setting process and in driving performance.

B. User Story

A user story is an informal description, written in naturalistic language and focused on one or more features of a software system. User stories are often written from the perspective of an end user or a system user. They are often recorded on index cards, Post-it notes, or in project management software. Depending on the project, user stories may be written by various stakeholders, including clients, users, managers and development team members.

User stories are a type of boundary object. They facilitate sense-making and communication, that is, they help software teams organize their understanding of the system and its context.

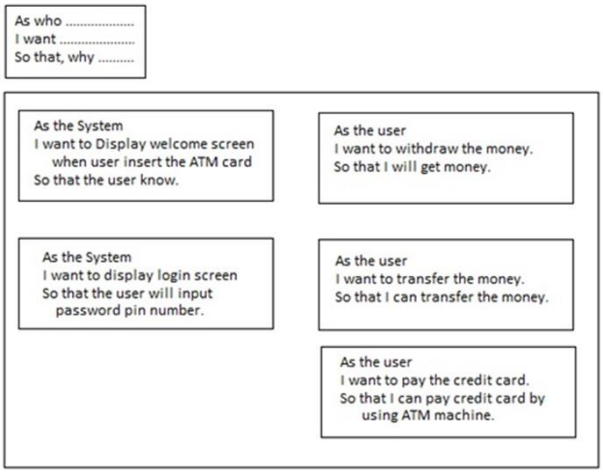


Figure 1. User Story of ATM System

C. UML (Unified Modelling Language)

The Unified Modelling Language (UML) is a standard visual modelling language intended for use by modelling business and processes. It is a common language for business analysts, software architects and developers used to describe, specify, design and document existing or new business processes, structures and the behavior of artefacts in software systems.

D. Class and Object

A class represents a collection of objects having the same characteristic properties that exhibit common behavior. An object is made up of both behavior and data. Data is represented as the properties of the object and behavior as a method. In this way, it is both unique and without boundaries.

A class is a description of a set of objects that share the same responsibilities, relationships, operations, attributes and semantics. A class also defines an object and the template for the structure and behaviour of all of its objects. The objects created in a class are also called the instances of the class. The class is the static description and the object is a run-time instance of that class. There is a distinction between a real-world object, which they are modelled from, and software objects, which exist only within the context of the system.

Developers start with real-world objects, remove the abstract elements that the reader will not be interested in and then take these abstractions and go through the process of classification based on what the users actually care about. The classes in this model are the result of this classification process.

These classes are used as templates within an executive software system to create other software objects. These software objects represent real-world objects.

E. Analysis Model

Analysis models represent an early conceptual model for the things in the system which have responsibilities and behaviour. It eventually evolved into classes and subsystems in the Design Model. The Analysis Model was developed from the noun in the scenario.

F. Relationships with Humans

The relationship between humans and their environment as mentioned in Object-Oriented Programming (OOP) can be defined by the idea that "Everything is an Object", which means the developer has to consider everything in terms of objects and their relationships with each other. The types of relationships in the real world that could be used to map computer programming can be classified, as follows:

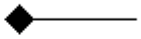
Relationship	Symbols
Association	
Composition	
Aggregation	
Dependency	
Generation	
Realization	

Figure 2. Relationships and Symbols

With the use of these symbols, developers can translate into any OOP languages. Thus, human relationships could also serve to map computer languages as well.

G. Paired t-test

The paired sample t-test, also known as the dependent sample t-test, is a statistical procedure used to determine

whether or not the mean difference between two sets of observations is zero. In a paired sample t-test, each subject or entity was measured twice, which resulted in pairs of observations. Common applications of the paired sample t-test include case-control studies or repeated-measures designs. Suppose that you are interested in evaluating the effectiveness of a company-training program. One approach you might consider would be to measure the performance of a sample of employees before and after completing the program and then analyze the differences using a paired sample t-test.

$$t = \frac{\frac{\Sigma d}{N}}{\sqrt{\frac{\Sigma d^2 - \frac{(\Sigma d)^2}{N}}{N(N-1)}}} \quad (1)$$

Where D is different between matched scores
N is the number of pairs of scores
df is N (number of pairs) – 1

H. Partial Correlation

Partial correlation is a measure of the strength and the direction of a linear relationship between two continuous variables, whilst controlling the effect of one or more other continuous variables also known as 'covariates' or 'control' variables. Although partial correlation does not make the distinction between independent and dependent variables, the two variables are often considered in such a manner. There was one continuous dependent variable, one continuous independent variable and one or more continuous control variables.

$$r_{12.3} = \frac{r_{12} - r_{13}r_{23}}{\sqrt{1 - r_{13}^2}\sqrt{1 - r_{23}^2}} \quad (2)$$

Where rmn is the correlation of the variables m and n
r12.3 is the correlation of variables 1, 2 and 3, while 3 was eliminated

III. RESEARCH PARADIGM

This research is one-short case study. It is a type of pre-experimental research design. A single group was studied at a single point in time after treatment presumed to have instigated change. Therefore, the students were able to teach the concepts of Scenario Analysis and Picture Story. A test was then given after each of the lectures. However, the researcher did not classify the students into smaller groups, based on ability. Therefore, the score of Object-Oriented Programming (OOP) was collected as control variable.Create

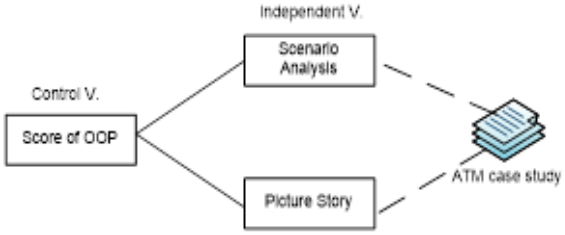


Figure 3. Research Paradigm

ATM Case Study

For the purposes of this study, the ATM case study was used to develop it. The students were given a problem statement and a system specification, both of which were in Thai. The students had to underline nouns in the statement of the problem and then to draw a diagram illustrating their relationship between them. The tentative correct answer should look like Figure 4.

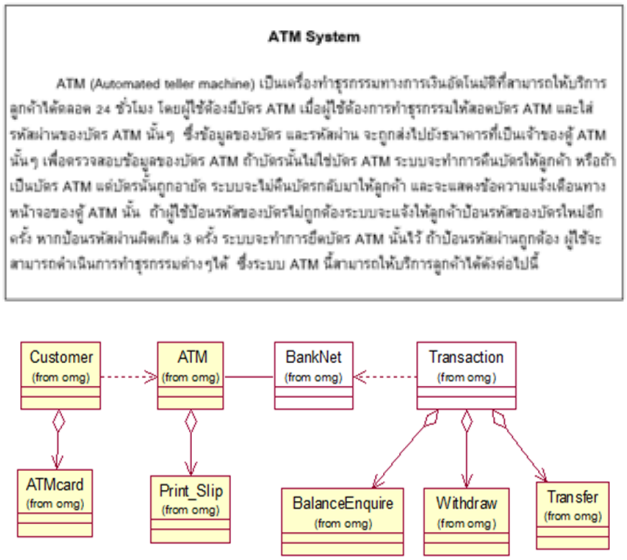


Figure 4. Problem Statement of ATM Case Study
And Analysis Class on ATM Case Study

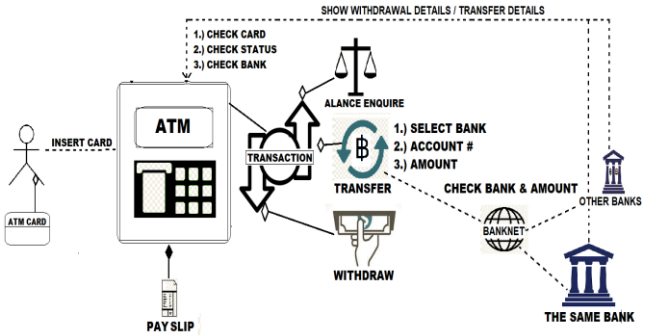


Figure 5. Show Problem Statement and Tentative Class Diagram

IV. Research Findings

After the lecture of how to find a class and perform an analysis by using a noun in the statement of the problem. The student was given a test on an ATM case study. Then the researcher gave a lecture that provided an example of a Picture Story and a test of the ATM case study. Since the researcher did not control the variable, the OOP scores of each student were collected and used as Partial Correlation to eliminate the influence of OOP scores. The results are shown below, as follows:

Table 1: Partial Correlation between Scenario Analysis and Picture Story

Control Variables			Scenario	PictureStory
OOP	Scenario	Correlation	1.000	.820
		Significance (2-tailed)	.	.000
		df	0	67
	PictureStory	Correlation	.820	1.000
		Significance (2-tailed)	.000	.
		df	67	0

There was a high level of correlation between the Scenario Analysis and Picture Story scores. It was equal to 0.82, while the influence of OOP scores were eliminated.

The scores on the ATM case study using Picture Story and Scenario Analysis were computed using a paired t-test. It was equal to 19.47 at a level of 0.00 significant therefore, the performance of the students the on Analysis Model using Picture Story was more effective than Scenario Analysis. The details were shown in Table 1.

Table 2: A t-test paired between Picture Story and Scenario scores in an ATM Case Study

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean	df	t	Sig.(2-tailed)
Pair 1	PictureStory	38.2286	70	11.12664	1.32989	69	19.468	.000
	Scenario	22.7857	70	10.83191	1.29466			

V. Conclusion

The scores of the students acquired by identifying that the Analysis Class using Picture Story was more effective than Scenario Analysis. Somehow, there was a correlation between both methods on the class findings. It might also be the result of the same ATM case study. Therefore, the next related research should use experimental research and diffidence case studies.

VI. Acknowledgments

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