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Students' Preference on Mathematics Classroom Using Conjoint Analysis

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Abstract

Mathematics is one hardest subjects that most students considered. Most studies on mathematics education are centered on the intra of the learning process and forsaking the inter component of it. The study is interested to look on students' preference on a mathematics classroom. Four factors are being considered in the study namely type of instruction which is either teacher lecture, student reporting or combinations of them; class schedule which is either early morning, middle morning, late morning, early afternoon, middle afternoon or late afternoon; medium of instruction which is either English or local language or combination of them; and teaching strategy which is either chalk-talk, computer assisted instruction or combination of them. Orthogonal design generates twenty-nine (29) combinations of these factors. The researcher had asked 189 students who were enrolled in mathematics last 1st Semester, SY 2017 – 2018 to rank them as to their most preferred mathematics classroom. Conjoint analysis was used to analyse the data. Results show that students most preferred on mathematics class where teacher is sometimes the one lecturing and students also are given topics to be reported, scheduled in 2nd or 3rd period in the morning, discussed in English and local language, and utilized computer in delivery of instruction. It also shows that students give so much importance on class scheduling over other factors. Results were being discussed in terms of the increasing awareness about mathematics education where students consider as an ideal mathematics classroom.

Keywords – mathematics classroom, conjoint analysis, student's preference

INTRODUCTION

Mathematics is considered the queen of all sciences [6] because it always connects itself with other fields such as physical sciences, biological sciences, and social sciences [14]. It is concerned with physical reality [5], gives meaning to business, helps establish national security and prosperity, and even addresses the problems of industries such as those in chemical industry, oil exploration, medical imaging, logistics and transportation, information security, communications, entertainment, and microelectronics and nano-electronics [35].

In recent years, performance of students in mathematics has declined in the Philippines [26] and in other parts of the globe [30]. There is a trend of poor performance in mathematics from national tests [9][18][31] to international examinations [1][23]. Reports from the Programme for International Student Achievement (PISA) and Trends in International Mathematics and Science Study (TIMSS) in the United States of America show that majority of students around the world have problems in learning the subject [1].

Several studies were conducted to find the reasons behind the problem as well as to find ways in solving this dilemma. For instance, some studies suggest that the below par performance of the students could be due to educators' outdated teaching practices and the students' lack of basic skills in mathematics [30][43]. Experts who studied the problem advanced several ways to either completely eliminate or to minimize the problem. The solutions they suggest range from government programs [9] to classroom practices [18].

It has to be noted that most researches conducted along in solving problems on the decline of students' academic performance on mathematics are mostly centered on intra-personal factors of students [12][41]. For instance, it was found that Kolb Learning Style Inventory is a good predictor whether a student preferred a team-based learning or not. Additionally, it is interested to look whether students are visual, auditory or group learners; and later concluded that learning preference is related to memory, cognitive, compensation, metacognitive, and social strategies [12].

Scheduling of classes is associated with student performance [16][17][20][36]. For instance, students who belong to every other day schedule perform better [22] particularly in basic mathematics [29][16][36]. On the other hand, students who are enrolled in daily schedule perform better in higher algebra, biology and English [17].

Students respond differently to different instruction [4][32]. For instance, traditional one is students perform better in development reading skills under computer-based than print-based reading materials [38]. It was also found out that neophytes in direct instruction exert less mental effort and time than those in self-guided instruction [24]. Additionally, students have significant performance in task and effects of processing instruction than the [34]. Lastly, differentiated instruction offers bright hope for students than traditional discussion [33].

Medium of instruction plays a significant role in the learning process [11][15][25], and essential in teaching practice and successful teaching activities [44] because it is the information transmission medium between teacher and learner [12]. For instance, science education can easily be learned to non-English speaking country if English is used as medium of instruction [2]. English offers high absorption of lessons even to Thai people [10] and Zulu people [40].

Different teaching methods vary across disciplines [28] because the primary goal of teaching is to facilitate learning [8]. Engineering students preferred the use of technology in classroom discussion [19]; while economics class adhered to small group lecture approach [8]. On the other hand, traditional lecture is still adopted in science education [21]. Mathematics had been taught mostly in teacher lecture [3]. In the 21st century, computer-assisted instruction had been an advocacy of most educators [27][45] because it enhances learning [42] and motivates students to learn [13]. For instance, low achieving mathematics students had significantly improved their learning using this type of instruction [3] because it caters individual learning phase of students [39]. Aside from that it also minimizes student's absenteeism [37] and motivates teacher to do more in classroom [7].

Most studies considers intra-factors of learner but failed to consider environmental ones [41] such as type of instruction, class schedule [46], medium of instruction, and teaching strategy. Thus, this study utilizes conjoint analysis to determine the ideal classroom setting for mathematics class in terms of teaching strategy, class scheduling, type of instruction, and medium of instruction. Additionally, it has to be considered that learning styles and preferences varies across people and even influenced by culture. As such, this study is interested to highlight the local tribe, Mandaya, preferences on mathematics classroom.

OBJECTIVES OF THE STUDY

This is study is interested to determine what factor is being considered important by students in terms of mathematics classroom – teaching strategy, class scheduling, type of instruction, and medium of instruction. Furthermore, this study is concerned to determine the most preferred mathematics classroom setting as viewed by students.

MATERIALS AND METHOD

The study used descriptive design and particularly adopts one – shot survey design which allows the researcher to gather data at one point in time from the respondents. Respondents of the study were students of Davao Oriental State College of Science and Technology – Cateel Campus during 1st

Semester of SY 2017 - 2018. The study used complete enumeration of students who are currently enrolled in any mathematics class.

This study used a research questionnaire that asked respondents to rank from most to least preferred variable combinations among class schedule (early, middle or late morning; or early, middle or late afternoon); types of instruction (teacher lecture, student reporting or combination of teacher lecture and student reporting); medium of instruction (English, local language or combination of English and local language); and teaching strategy (traditional, computer-assisted, or combination of traditional and computer-assisted). These combinations were generated from orthogonal design of statistical software which was the first approach of conjoint analysis.

Permission to conduct survey was obtained from the DOSCST administration as well as from mathematics instructors whose students were identified to answer the survey questionnaire. The respondents were instructed to answer the questionnaire without time limit that they were comfortable with. They will also be informed about the purpose of the study.

RESULTS AND DISCUSSION

There were 189 students' respondents of the study who were enrolled in mathematics class namely college algebra and trigonometry, plane trigonometry, contemporary mathematics, and quantitative techniques in business. They were asked to rank twenty-nine (29) set of preferences which is a combination of different factors of independent variables with different attributes. Rank 1 would mean the most preferred and 29 would be the least.

Students most preferred that mathematics class will be a combination of teacher lecture and student reporting in terms of instruction because it has utility estimate of 0.446 (see Table 1) which is the highest among other attributes. In terms of class schedule, they most preferred on the middle morning time slot for mathematics class because it has utility estimate of 0.826. Additionally, they mostly agreed that mathematics class will be taught in combination of English and local language with a utility estimate of 0.517. Further, they mostly wanted a computer-assisted lecture with utility estimate of 0.440 rather than chalk-talk lecture (traditional lecture) or a combination of them. In short, students preferred attributes on mathematics classroom as combination of teacher lecture and student reporting which will be scheduled on middle of the morning and delivered using English and local language with the use of computer or known as computer-assisted instruction.

Table 1. Utilities of each attribute

Factor	Attributes	Utility Estimate	Std. Error
Type of Instruction	Teacher Lecture	–0.243	0.376
	Student Reporting	–0.203	0.376
	Combination of Teacher & Student Report	0.446	0.376
Class schedule	Early Morning	–0.699	0.541
	Middle Morning	0.826	0.541
	Late Morning	0.362	0.541
	Early Afternoon	–0.829	0.711
	Middle Afternoon	–0.374	0.711
	Late Afternoon	0.714	0.711
Medium of Instruction	English	–0.078	0.376
	Local Language	–0.440	0.376

	Combination of English & Local Language	0.517	0.376
Teaching Strategy	Traditional Lecture	–0.072	0.376
	Computer-Assisted Lecture	0.440	0.376
	Combination of Traditional & CA Lecture	–0.368	0.376
(Constant)		13.946	0.282

Table 2. Important values

Factor	Values
Type of instruction	21.396
Class schedule	41.416
Medium of instruction	17.791
Teaching strategy	19.397

Conjoint analysis do not just captured most preferred attribute but also which factor that students considered most important (see Table 2). Students considered class schedule as most important over other factors because it has value of 41.416 which is the highest among others. This means that among factors considered in this study, they mostly look class schedule as top most important in considering an ideal mathematics classroom.

Performance on mathematics of most students around the globe including the Philippines had been declining. Most studies are particular on the intra-level of learners but seldom to look on the set-up of mathematics classroom. Some of them begin with profiling learner's profile as to their inclination in the learning process but forget to look the outside of the learning process.

Results show that in order to take a full advantage of mathematics learning process, higher education institution, in particular, needs to schedule mathematics class in 2nd or 3rd period in the morning. They need to design policies that instruction will be delivered where teacher and students are working together in class discussion. Discussion can be done either in English or local language to ensure that learning is maximized. Lastly, instruction requires the use of computer in the discussion either as a supplement or main delivery mode.

In short, instruction should focused on the when of the mathematics class rather than on the "who" and "how" of it. Mind receptiveness is of great importance if we are going to ensure mathematics learning. Indeed, every teacher should not just focus on their teaching strategy and delivery of instruction but rather on the alertness of students to receive learning and inputs.

CONCLUSION & RECOMMENDATIONS

The study contributes to the increasing awareness on ideal mathematics classroom that students consider. It can help institutions to position themselves in ushering a wide flow of mathematics learning. Students are more particular on their readiness in mathematics classroom as revealed by their time preference. While most studies are particular on the learning preferences of students, this study complements such studies by giving them inputs that in maximizing learning it requires consideration on alertness or readiness of their minds. Indeed, the study shows that students are not so particular on the "who" and "how" of the learning process but on the "when" of it. Thus, they view learning as a process with time element that signals the alertness of mind when to receive and digest it.

The study had captured students' preference on mathematics classroom that can help facilitate a smooth flow of learning. Students give importance on class scheduling over other factors of the study. Further, they mostly preferred a teacher and student lecture exchange using English and local language with the aid of computer technology. With this premise, the researcher suggests that this result will be presented to academic institutions'

administrators and managers so that they can consider the result in preparing faculty loading and class scheduling.

The researcher also suggests that faculty will be informed of the result of this study so that they can employ teaching strategy and intervention alongside with the finding. Giving importance on the preference can help students work at their level and remove obstruction of the learning process. On the other hand, the study considers only four variables namely teaching strategy, class schedule, medium of instruction and type of instruction, however, some other variables can be considered in future studies to make it more encompassing and holistic. Moreover, the study can be enhanced when preferences will be subjected for level of agreement or disagreement between math and non-math major students using discriminant analysis. Lastly, finding of the study is good to be subjected for quasi-experimental study for validity of its result.

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