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Differences in Software Usability Level Based on User Background

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ABSTRACT

The development of software must consider usability as one of its key success indicators. Relatively few studies discuss the factors influencing usability, including users' backgrounds. The purpose of this research was to investigate the impact of user background, specifically gender, class (year of college admission), and frequency of use on the rating of usability. This research utilized a descriptive quantitative method with instruments: the usability matrix of the Computer System Usability Questionnaire (CSUQ), the System Usability Scale (SUS), the Usability Metric for User Experience (UMUX), and the Net Promoter Score (NPS). The research object was the Learning Management System (LMS) of two state universities in Yogyakarta. Two sets of questionnaire responses were obtained: 305 men and 442 women answered the first time, and 280 men and 584 women answered the second time. Our result shows that the mean value of usability level from CSUQ, SUS, UMUX, and NPS is mostly higher in female than male respondents, in junior to more senior students, and in respondents who use the system more frequently than those who use it less. This trend was consistent, even though the sequence of questionnaire choice order was reversed between the first and second data collection at the two universities. This research hence concluded that, based on gender, women tend to offer a higher rating of usability than men; based on class, the younger generation tends to provide higher ratings of usability than the older generation, and users who use the system more frequently tend to give higher usability rating than those who less use it.

Keywords*:* usability, software quality, user background

INTRODUCTION

Learning Management System (LMS) is a system designed to handle education-related learning [1]. This system was developed specifically to be able to manage and facilitate mediafor the distance learning process [2]. With the LMS, learning evaluation, particularly the evaluation of the learning process, can be maximized. The existence of a learning management system is anticipated to narrow the "gap" between online and/or blended learning and traditional learning.

This research was carried out at the State Universities University A and University B in Yogyakarta, Indonesia. University A and University B are campuses in Yogyakarta that utilize the LMS for learning activities. The two LMS feature users with diverse genders, socioeconomic statuses, and frequencies of use. The *User Experience* (UX) is an important metric for measuring the ease of use of a website, particularly one designed to support the learning process, which is generally referred to as a LMS [3]. Interface is crucial for a website system [4] as nearly all websites include a user *interface*. A poor *interface* frustrates users and has a negative impact on productivity and the experience of visiting a website [5]. The level of usability of a system is directly proportional to the quality of the *User Experience And User Interface*. Aspects of usability can be employed to make sure that interface and interaction design are done well to facilitate interaction [6]. The usability component is crucial since it shows how user-friendly an application is, which can boost its productivity [7].

Using descriptive analysis of the LMS of University A and University B, it is possible to conduct a study to assess the effect of user background, particularly gender, class, and frequency of usage, on the level of usability. Utilizing the CSUQ, SUS, UMUX, and NPS matrices, previous research has been undertaken to determine the degree of reusability. The research titled [8] was undertaken to create the

user interface of the abelima website utilizing the CSUQ method to determine user satisfaction. The results of the analysis indicate that satisfaction with the completeness of features on the Abelima website has the lowest mean value of 5.00, while satisfaction with the ease of use of the Abelima Studio website has the highest mean value of 6.10. The results of the user satisfaction analysis indicated that respondents were satisfied with the Abelima website as a whole.

According to research conducted [9], the results of usability testing on the Pijar Career Center's interface indicate that the typical work scenario can be done effectively. Using the SUS technique, a result of 79 indicates that the Incandescent Career Center application is exceedingly usable, as it is above average. Further research was undertaken by identifying the issues that led to the decline in user numbers. Because SUS is not diagnostic, further evaluation methods are required to identify the problem.

Research conducted by [10] User Experience testing was carried out on the Gojek and Grab applications. According to the results of testing the processed data, it can be determined from the Paired Sample Test table that the average level of happiness among Gojek and Grab program users is identical. The efficacy component of the usability measurement for the Gojek and Grab programs yields a rating of 100 percent for each task. Then, the efficiency component for Goride (0.0051 goal/sec and 100%), Gofood (0.0058 goal/sec and 100%), Grabbike (0.0054 goal/sec and 100%), and finally Grabfood (0.0061 goals/sec and 100%).

Research carried out by [11] shows that the median age of responders is 43.60 years. The majority are female BPJS Health patients with a high school education. The average patient/family NPS score is 6.68, with the bulk of responders exhibiting characteristics of detractors.

The availability of facilities (mushola, air conditioning, fans, and room lighting) and cleanliness are RSUD Kota X's worst deficiencies in terms of inpatient care (rooms, bathrooms). The queue system, the availability of facilities (mushola, air conditioning, fans, room lighting), the lack of clarity of information and treatment flow, and the lack of sanitation are weaknesses of outpatient services (rooms, bathrooms). The City X Hospital's inpatient services are bolstered by the friendliness of the officers (doctors, nurses, administration), the quickness of BPJS services, and the quality of service. The friendliness of the personnel (doctors, nurses, administration) and the quality of service are strengths in the provision of outpatient care. The addition of hospital facilities is the most common recommendation made by both inpatient and outpatient patients.

As far as our knowledge, there is no study that combines a number of usability assessment instruments as in our research. Specifically, our study combines the usability matrix of the Computer System Usability Questionnaire (CSUQ), the System Usability Scale (SUS), the Usability Metric for User Experience (UMUX), and the Net Promoter Score (NPS). Previous research mostly used one type of instruments.

One of the main problems that LMS developers currently face is that there is no insight for them in regard to the type of factors that can influence the perception of the LMS' usability based on the users' background. There is no research, as far as our exploration, that elaborates on the influence of users' backgrounds on the perceived level of software system application usability.

METHODS

This research was designed to examine the impact of user background, such as gender, class (year of college admission), and frequency of use, on the usability level of the LMS at universities A and B. This research follows a quantitative research approach. Quantitative research is a type of research that structures and quantifies data so that it can be generalized. Quantitative data is data in the form of numbers [12]. Measurable and verifiable data are systematically gathered and evaluated through the process of quantitative data analysis [13].

Descriptive analysis and inferential analysis are two types of quantitative data analysis. The purpose of descriptive analysis is to observe a conclusion. Meanwhile, inferential analysis is used as a basis for inferring and drawing conclusions in general [14].

Quantitative data are a type of data collected by the reseacher in numerical format. Those numerical format is not a symbol, but rather is the data in its original form (eg, age, monthly income, grades or achievement scores, number of children, length of work). Quantitative data can be divided into discrete and continuous categories based on how they are collected. Discrete data are those which is collected through enumeration. While continuous data are those which is collected through measurements [15].

According to [16], descriptive research is carried out by gathering data on the occurrence of phenomena, evaluating the goals to be achieved, arranging the strategy to be utilized, and collecting various forms of data that will be reported on. In essence, descriptive quantitative research is a type of research that always collects and analyzes data in numerical form to produce a research report. Data gathered during this descriptive quantitative study were analized using statistical techniques. In addition, the study was designed employing a survey. Data was collected using questionnaires.

Survey research is a kind of research that tries to (1) collect a thorough factual information that characterizes the existing phenomena; (2) identify problems or provide justification for the current situation and ongoing activities; and (3) as a resource for future planning and decision-making, to discover what people who are the subject of research do to solve difficulties [17]. Research instruments with this type of survey research use devices to measure to a phenomenon. The number of research instruments depends on the number of variables previously established research. The instrument in this research uses tools in the form of a questionnaire [18].

The purpose of the survey is to gather a general description of the population's characteristics, such as its composition by age group, gender, education, occupation, religion, ethnicity, and others. In addition, surveys can be used to collect information regarding attitudes, values, views, opinions, stances, wants, ideals, behaviors, and habits, among others [17]. Our research followed the stages as explained in [19] i.e.: (a) define and formulate the problem; (b) literature study; (c) formulate a hypothesis; (d) determine the model; (e) collect data; (f) processing and presenting data; (g) analyze and interpret processing results; (h) make generalizations (conclusions) and recommendations (suggestions); and (i) make a final report on research results.

RESULT AND DISCUSSION

A. Instrument Arrangement

In this research, a statement-style questionnaire was used. This research questionnaire has 29 statements overall. There are 14 statements taken from the Computer System Usability Questionnaire (CSUQ) [20], [21] which can be seen in Table 1.

Table 1. The Questionnaire of CSUQ

No	Statement
1.	Overall, I am satisfied with how easy it is to use this system.
2.	It was simple to use this system.
3.	I am able to complete my work using this system.
4.	I feel comfortable using this system.
5.	It was easy to learn to use this system.
6.	I belive I became productive quickly using this system.
7.	The system gives eror messages that clearly tell me how to fix problems.
8.	Whenever I make a mistake using the system, i recover easily and quickly.
9.	The information (such as online help, on-page message, and other documentation) provided with this system is clear.
10.	It is easy to find the information I needed.
11.	The interface of this system is pleasent.
12.	I Liked using the interface of this system.
13.	This system has all the functions and capabilities I expect it to have.
14.	Overall, I am satisfied with this system.

Apart from these 14 statements, a further 15 statements were taken from: 10 statements taken from the System Usability Scale (SUS) [22], [23] as in Table 2, in Table 3 are statements taken from the Net Promoter Score (NPS) [24], and 4 statements taken from Usability Metric for User Experience (UMUX) [25] which can be shown in Table 4.

Table 2. The Questionnaire of SUS

No	Statement
1.	I think that I would like to use this system frequently.
2.	I found the system unnecessarily complex.
3.	I thought the system was easy to use.
4.	I think I would need the support of a technical person to be able to use this system.
5.	I found the various function in this system were well integrated.
6.	I thought there was too much inconsistency in this system.
7.	I would imagine that most people would learn to use this system very quickly.
8.	I found the system very cumbersome to use
9.	I felt very confident using the system .
10.	I needed to learn a lot of things before I could get going with this system.

Table 4. The Questionnaire of NPS

No	Statement
1.	How likely is it that you would recommend this system to a friend.

Table 3. UMUX Questionnaire on Usability Metrics

No	Statement
1.	This system's capabilities meet my requirements
2.	Using this system is a frustrating experience.
3.	This system is easy to use.
4.	I have to spend too much time correcting things with this system.

B. Population and Sampling

Population is defined as a whole element or elements that we will examine. Meanwhile, the sample is a snapshot of the population to be studied [26]. The size of the population of University A and B was drawn from the information mentioned in [27]. The sampling size was calculated following Isaac and Michael sampling.

In this research, a 5% margin of error was applied. The sample size for University A in this study is 342, while for University B is 344. The sample was taken from actively enrolled students and those who had graduated from the classes of 2016 through 2022. The information regarding data collection at University A and B is outlined in Table 5.

Table 5. Data Collection Information

Data Collection	Time	Respondents Completely Fill Questionnaire				Population
		Total	Gender	Year of Admission	Frequency of Use (per week)	
University A 1st Data Collection	24 August 2021 until 26 October 2021	425	375 (Men: 185; Women: 190)	375 (2017: 4; 2018: 38; 2019: 130; 2020: 203)	375 (-: 6; 0: 5; 1: 28; 2: 21; 3: 31; 4: 18; 5: 50; 6: 25; 7: 38; 8: 12; 9: 3; 10: 56; >10 : 82)	24.621
University A 2nd Data Collection	14 January 2022 until 16 March 2022	444	438 (Men: 165; Women: 273)	438 (2016: 4; 2017: 14; 2018: 57; 2019: 207; 2020: 106; 2021: 48; 2022: 2)	438 (-: 2; 0 : 13; 1: 39; 2: 44; 3: 39; 4: 19; 5: 57; 6: 28; 7: 69; 8: 15; 9: 6; 10: 31; >10: 76)	24.621
University B 1st Data Collection	24 August 2021 until 18 January 2022	383	375 (Men: 120; Women: 252)	375 (2015: 10; 2016: 13; 2017: 38; 2018: 73; 2019: 40; 2020: 137; 2021: 61)	375 (-: 15; 0: 32; 1: 64; 2: 34; 3: 28; 4: 19; 5: 62; 6: 15; 7: 49; 8: 2; 9: 4; 10: 22; >10: 29)	34.997
University B 2nd Data Collection	14 February 2022 until 16 March 2022	431	426 (Men: 115; Women: 311)	426 (2015: 2; 2016: 19; 2017: 12; 2018: 39; 2019: 172; 2020: 94; 2021: 88)	426 (-: 1; 0: 27; 1: 45; 2: 38; 3: 49; 4: 27; 5: 55; 6: 39; 7: 54; 8: 8; 9: 2; 10: 28; >10:53)	34.997

In this research, data collection was conducted twice by reversing the order of the questionnaire's answer options (which used a Likert scale). The purpose of the reversal is to validate the collected data. The order of questionnaire choice options is described in Table 6.

Table 6. Questionnaire Answer Choice Order

Data Retrieval	University A	University B
1st Data Collection	Strongly Disagree (STS) —> Strongly Agree (SS)	Strongly Agree (SS) —> Strongly Disagree (STS)
2nd Data Collection	Strongly Agree (SS) —> Strongly Disagree (STS)	Strongly Disagree (STS) —> Strongly Agree (SS)

Whether the reversal has any impact on the acquired outcomes will be demonstrated through data analysis. The outcomes will be reflected in the conclusion.

C. Data analysis

Based on data analysis, the results of using CSUQ, SUS, UMUX, and NPS Metrics for Usability by Gender can be seen in Figure 1. Figure 1 (a, b, c) demonstrates that the usability rating provided by female respondents at Universities A and B is always greater than the rating provided by male respondents.

Figure 1 (d) demonstrates that the usability value provided by female respondents is always greater than the usability value provided by male respondents at University A and University B, with the exception of University B Research 2 where female respondents provide a lower usability value than male respondents.

Based on data analysis, the results of using CSUQ, SUS, UMUX, and NPS Metrics for Usability by Class (year of college admission) can be seen in Figure 2, Figure 3, Figure 4 and Figure 5.

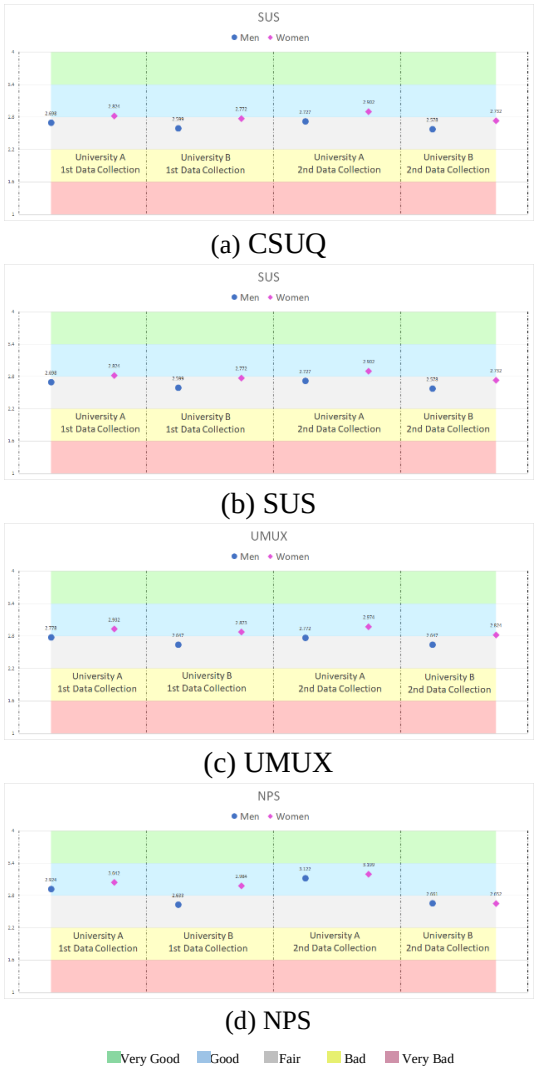

Figure 1. Graph by gender

Figure 2 shows that in the first data collection at University A, an upward trend line can be seen. It means that younger classes tend to provide higher usability ratings than the older class. In the second data collection at University A, an upward trend line can be seen. It means that younger classes tend to provide higher usability ratings than older peers. In the first data collection at University B, an upward trend line can be seen. It means that younger classes tend to provide higher usability ratings than the older class. In the second data collection at University B, an upward trend line can be seen. It means that younger classes tend to provide higher usability ratings than older peers.

Figure 2. Graph by Class (year of college admission) of CSUQ (left to right: University A on 1st data collection; University A on 2nd data collection; University B on 1st data collection; University B on 2nd data collection)

The *Usability* level by class based on the "SUS metric" which is illustrated in Figures 3 shows that: (a) The first data collection at University A reveals a rising trend line. It means that younger class tend to provide higher usability rating than the older class; (b) The second data collection at University A reveals an upward trend line. It means that younger class tend to provide higher usability rating than the older peers; (c) In the first data collection at University B, a rising trend line is observed. It means that younger class tend to provide higher usability rating than the older class; and (d) In the second data collection from University B, a declining trend line is seen. It means that younger class tend to provide lower usability rating than the older peers.

Figure 3. Graph by Class (year of college admission) of SUS (left to right: University A on 1st data collection; University A on 2nd data collection; University B on 1st data collection; University B on 2nd data collection)

The *Usability* level by class as measured by the "UMUX metric" in Figures 4 shows that: (a) In the first data collection at University A, an upward trend line can be seen. It means that younger class tend to provide higher usability rating than the older class; (b) In the second data collection at University A, a rising trend line is observed. It means that younger class tend to provide higher usability rating than the older peers; (c) In the first data collection at University B, a rising trend line is observed. It means that younger class tend to provide higher usability rating than the older class; and (d) In the second data collection from University B, an upward trend line is seen. It means that younger class tend to provide higher usability rating than the older peers.

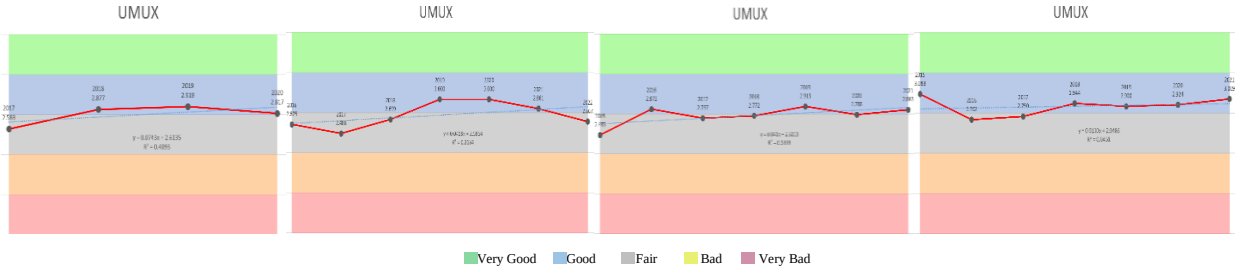

Figure 4. Graph by Class (year of college admission) of UMUX (left to right: University A on 1st data collection; University A on 2nd data collection; University B on 1st data collection; University B on 2nd data collection)

The usability level by class as measured by the "NPS metric" in Figures 5 reveals that: (a) In the first data collection at University A, an upward trend line can be seen. It means that younger class tend to provide higher usability rating than the older class; (b) In the second data collection at University A, it shows an uptrend line. It means that younger class tend to provide higher usability rating than the older peers; (c) In the first data collection from the University of B reveals an upward trend line. It means that younger class tend to provide higher usability rating than the older class; and (d) In the second data collection from University B, a declining trend line can be seen. It means that younger class tend to provide lower usability rating than the older peers.

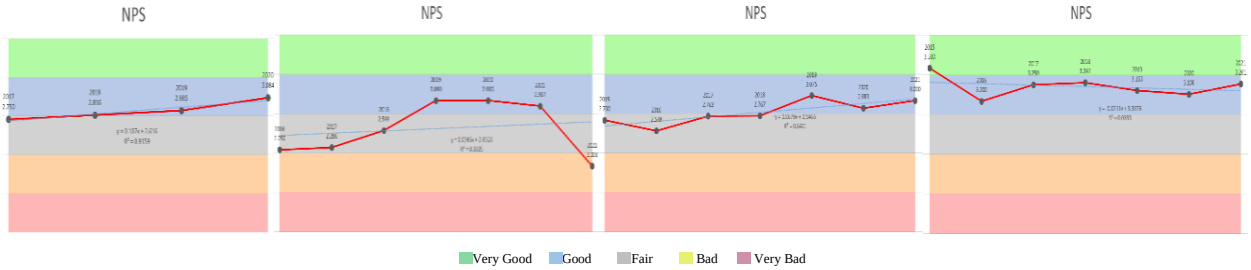

Figure 5. Graph by Class (year of college admission) of NPS (left to right: University A on 1st data collection; University A on 2nd data collection; University B on 1st data collection; University B on 2nd data collection)

The *Usability* level by usage frequency as measured by the "CSUQ metric" in Figure 6 reveals that: (a) In the first data collection at University A, it shows an uptrend line. It means that users who have more frequent access tend to give higher usability score than those who is less frequent; (b) The second data collection at University A reveals an upward trend line. It means that users who have more frequent access tend to give higher usability score than those who is less frequent; (c) In the first data collection from the University of B reveals an upward trend line. It means that users who have more frequent access tend to give higher usability score than those who is less frequent; and (d) In the second data collection from University B, an upward trend line is seen. It means that users who have more frequent access tend to give higher usability score than those who is less frequent.

Figure 6. Graph by Usage Frequency (year of college admission) of CSUQ (left to right: University A on 1st data collection; University A on 2nd data collection; University B on 1st data collection; University B on 2nd data collection)

The *Usability* level by usage frequency as measured by the "SUS metric" in Figures 7 reveals that: (a) The first data collection at University A reveals a rising trend line. It means that users who have more frequent access tend to give higher usability score than those who is less frequent; (b) The second data collection at University A reveals an upward trend. It means that users who have more frequent access tend to give higher usability score than those who is

less frequent; (c) In the first data collection at University B, a rising trend line is observed. It means that users who have more frequent access tend to give higher usability score than those who is less frequent; and (d) In the second data collection from University B, a declining trend line can be seen. It means that users who have more frequent access tend to give lower usability score than those who is less frequent.

Figure 7. Graph by Usage Frequency (year of college admission) of SUS (left to right: University A on 1st data collection; University A on 2nd data collection; University B on 1st data collection; University B on 2nd data collection)

The *Usability* level by usage frequency as measured by the "UMUX metric" in Figure 8 shows that: (a) In the first data collection from University A, a rising trend line can be seen. It means that users who have more frequent access tend to give higher usability score than those who is less frequent; (b) In the second data collection from University A, a rising trend line is observed. It means that users who have more frequent access tend to give higher usability score than those who is less frequent; (c) The first data collection from the University of B reveals an downward trend line. It means that users who have more frequent access tend to give higher usability score than those who is less frequent; and (d) In the second data collection from University B, a declining trend line is observed. It means that users who have more frequent access tend to give lower usability score than those who is less frequent.

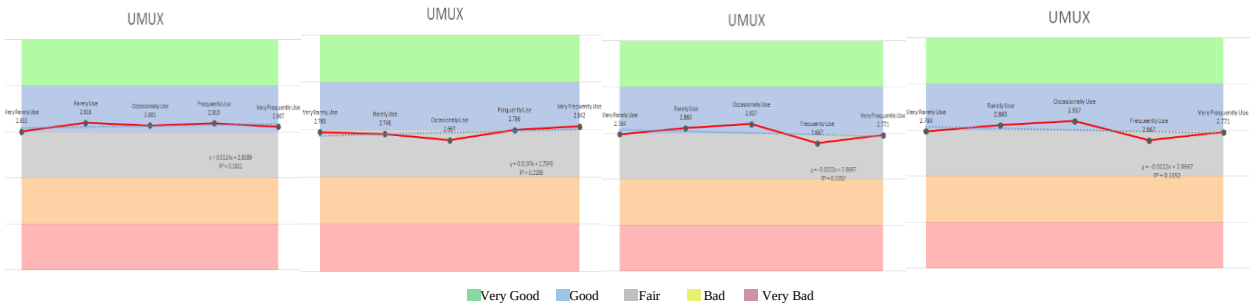

Figure 8. Graph by Usage Frequency (year of college admission) of UMUX (left to right: University A on 1st data collection; University A on 2nd data collection; University B on 1st data collection; University B on 2nd data collection)

The Usability level by usage frequency as measured by the "NPS metric" in Figure 9 reveals that: (a) The first data collection at University A reveals a rising trend line. It means that users who have more frequent access tend to give higher usability score than those who is less frequent; (b) The second data collection at University A reveals an upward trend. It means that users who have more frequent access tend to give higher usability score than those who is less frequent; (c) In the first data collection at University B, a rising trend line is observed. It means that users who have more frequent access tend to give higher usability score than those

who is less frequent; and (d) In the second data collection from University B, an upward trend line is seen. It means that users who have more frequent access tend to give higher usability score than those who is less frequent.

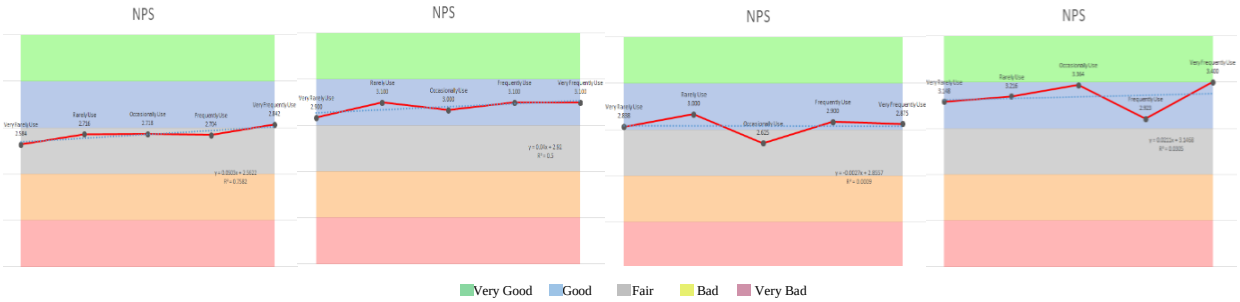

Figure 9. Graph by Usage Frequency (year of college admission) of NPS (left to right: University A on 1st data collection; University A on 2nd data collection; University B on 1st data collection; University B on 2nd data collection)

CONCLUSION

Based on our finding from this research (where data was collected twice from two universities, each of which with a reserse of choice option order in the questionnaire), we conclude that: (a) In terms of gender, women tend to offer higher usability rating than men; (b) In terms of generation (year of college admission), younger class tend to provide higher usability rating than their older peers; (c) In terms of usage frequency, users who have more frequent access tend to give higher usability score than those who is less frequent; (d) With the exception from the second data collection of University B measured in a very few metrics (i.e. CSUQ and UMUX), those trends as mentioned in the previous conclusion seem remain constant, despite the fact that the sequence of the questionnaire choce was reversed in the first and second data collections at the two universities; (e) The result of this research (usability level) provide insight for the developer to improve the LMS design by considering that gender, year of admsion, and frequency of LMS usage, the developer can focus to involve specific potential users which have more critical view regarding software system usability. By considering particular user background, developers can utilize it to improve the LMS UI/UX design quality by involving more critical users who tend to give low scores on LMS usability measurements (for example, users with male backgrounds, senior college students, and those who rarely use the LMS).

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