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Kano Lean Six Sigma (KLSS) for Improving Service Quality at Education Technology (EdTech) Startups

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Abstract

Companies' rapid development in Industry 4.0 and Society 5.0 is a significant challenge company faces in carrying out their business processes. Failure to capture consumers' factors and technical specifications significantly affects all business processes in a company. Today, consumers are looking for a standard product or service system and a product or service that can satisfy (delighter) them. This study evaluates and improves the service quality at EdTech (Education Technology) Startups using Kano Lean Six Sigma. This research will also review the effectiveness of Kano Lean Six Sigma in improving service quality at the startup company EdTech. This study uses the integration of Kano, Lean, and Six Sigma methods to capture customers' technical specification requests and improve process performance related to critical customer needs. The research method was carried out by conducting a literature study on Kano Lean Six Sigma and collecting data on the Startup EdTech company's service quality. The service quality parameters assessed are the suitability of the program with customer needs, response time duration, clarity of information, website usability, and mentoring quality. The Integrated Kano Lean Six Sigma method is suitable for planning and improving a product or system service quality to make it more effective and efficient. Thus, EdTech startup company can provide special programs based on customer needs with optimal service quality.

Keywords

Education Technology (EdTech) Startups, Industry 4.0, Kano Lean Six Sigma, Service Quality, Society 5.0

1. Introduction

The rapid development of technology in the Industry 4.0 and Society 5.0 era is a big challenge faced by companies in carrying out their business processes (Barbosa and Aroca 2017). The competitive market competition requires companies to have the correct segmentation and target market to satisfy customers. Failure to capture customers' factors and technical specifications significantly affect all business processes in a company. Today, customers are looking for a standard product or service system and a product or service that can satisfy them. This satisfaction parameter must be the company's main focus to provide the proper technical specifications and become superior to other companies (Siddiqui 2004). Therefore, the Kano Lean Six Sigma model improves the quality of a product or service system based on customer demand in various manufacturing and service industries. Kano Lean Six Sigma integrates Kano, Lean, and Six Sigma methods to capture technical specification requests from customers and improve process performance related to Critical Customer Requirements (Salah, Rahim, and Carretero 2009). The Kano method's existence can help capture demand and specification demands from customers, divided into basic specifications, performance, and delighter. This model diagram uses to compare the level of existence or matrix of a specification. If the company can only meet basic specifications, then the products or services provided will not increase customer satisfaction.

Performance specifications are specifications that must meet the customer's satisfaction. However, if these specifications are not meet the requirement, the customer will feel disappointed. The last is a delighter specification that is not mandatory for the company, but the customer will happy if delighter specifications exist. Delighted specifications can be a differentiator and make the product more unique compared to other competitors. Then, the Kano method can integrate with the Lean Six Sigma method, which focuses on minimizing misinformation, efficiency, and reducing waste. Combining these three methods can be used to plan and improve the quality of a product or system to be efficient and effective (Ullah and Tamaki 2011). This paper will discuss the application, development, and future research opportunities of Kano Lean Six Sigma (KLSS). The author also provides several

case study completions in various manufacturing and services companies using the Kano Lean Six Sigma method. Furthermore, this method can map to the model used to determine developments and research opportunities in the future.

1.1 Objectives

This study aims to improve the quality of service at Education Technology (EdTech) Startups using the Kano Lean Six Sigma (KLSS) method. This paper will analyze the comparison of service quality when implementing Kano Lean Six Sigma for aspects of response time duration, clarity of information, website usability, and mentoring quality.

2. Literature Review

The integration of the Kano model, Quality Function Deployment (QFD), and Six Sigma aim to improve and develop product innovations to minimize defects caused by the gap between customer requirements and company capabilities. Therefore, knowing the Voice of Customer (VoC) is a primary step that must be taken and appropriately understood so that companies can meet customer standard specifications. The results of the VoC are divided into 3 (three) types of clusters using the Kano Model, namely basic, performance, and delighter. After that, the company designs and develops products using QFD to select priority technical responses by considering lean and six sigma methods. The concept used is Design for Six Sigma (DFSS) or commonly called DMADV (Define, Measure, Analyze, Design, and Verify). Integrating these three methods positively impacts reducing defective products (not according to specifications) and making management better (concurrent engineering). Thus, the company can launch new products that follow market demands, are efficient, and effectively reduce defects in the production process. In its development, the integration of the model will be more complex, especially in determining the critical technical response because of Industry 4.0, which demands aspects of digitization. Specifications once a delighter can shift to a standard specification that must exist for a product (Khan et al., 2017).

In addition, the Kano Lean Six Sigma (KLSS) method can make quality improvement models identify unnecessary processes and balance (line balancing) between parallel processes in software maintenance. In this case, the initial stage in software development is to identify customer desires (Voice of Customer). Then, the company needs to map and cluster each existing specification using the Kano model. After mapping, the researchers determined the CTQ (Critical to Quality) and compiled product information using TPM (Total Productive Maintenance). To eliminate unnecessary processes, first, identify the problem with Pareto Chart and Root Cause Analysis. Furthermore, the identification of non-value added processes using FMEA (Failure Mode Effect Analysis). Management eliminates unnecessary processes (waiting time between one operational division and another programmer division) and performs parallel line balancing between divisions for time efficiency. Thus, the software development system can be carried out more quickly and prevent defects in the software. Significant changes in results can prove in the absence of bottlenecks throughout the software development process. In addition, the impact of a substantial improvement is the ease of communication and translating customer requirements into technical requirements that are friendly to programmers (Kumar and Dillibabu 2015).

After explaining the case study regarding software maintenance, the digital world began to move significantly and demanded various complex technical specifications in today's software design. The Kano Lean Six Sigma (KLSS) method can implement complex software design processes to map customer specifications and develop operational requirements or software specifications of quality and customer needs. The process of identifying customer requirements related to functional software specifications is called Requirement Elicitation (RE). First, complex customer specifications are identified by determining priorities based on resource analysis mapped using the DMAIC (Define, Measure, Analyze, Improve, Control) framework. Then, the second stage of the mapping process is to determine 3 (three) technical specifications consisting of basic, performance, and delighter. Next, heuristic methods determine the specifications that need in qualitative software design. After that, the company can produce an integrated conceptual framework based on the DMAIC framework with the Software Requirement Engineering methodology to optimize the Requirement Elicitation process. Then, customer requirements are determined using the CTQ Tree Diagram and the Six Sigma Project Charter. The KLSS method is proven to effectively improve business operational systems with a systematic and structured process. In addition, this method also contributes advantages in terms of operational and shipping costs. Using a conceptual framework as a guideline has also proven to be comprehensive to identify operational requirements or software specifications that are quality and targeted according to customer requirements (Salleh and Nohonuddin 2019).

Unlike the previous case studies related to the design and maintenance of a software product, combining the DMAIC Six Sigma method with AHP and the Kano Model evaluates supplier performance. Various problems faced by companies related to suppliers are the time to delivery, product quality consistency, and shipping costs. Many suppliers are inconsistent when delivering products; eventually, the product becomes the leading cause of product defects. These problems identify using the Six Sigma DMAIC (Define, Measure, Analyze, Improvement, and Control) methodology. In addition, another method used to identify processes in detail is SIPOC (Supplier, Input, Process, Output, Control). The first step is to determine the evaluation criteria through brainstorming in company meetings. After that, the company determines the weights using the Analytical Hierarchy Process (AHP) and is categorized based on the Kano Model (basic, performance, and delighter). After that, suppliers were assessed using a survey and classified according to the proposed methodology using a modified version of the Kano model. A performance evaluation model for suppliers using the Six Sigma (DMAIC) methodology has developed. If the results of this model are inconsistent with the company's business processes, the model will revise again. The research results prove that this method can evaluate suppliers' performance in specific sectors (Firat et al., 2017).

The successful integration of Lean Six Sigma, Kano, and Quality Function Deployment can prove in the product development design process. The continuous development of new products needs to pay attention to various factors and technical specifications to satisfy customers. As is well known, nowadays, the company aims to make standard products and delight customers with the latest features. Therefore, it is crucial to achieving a comprehensive understanding of the dynamic needs of customers using the Kano model. In addition, there is Six Sigma with the DMAIC method (Define, Measure, Analyze, Improve, Control) which use to reduce variability (Mast and Lokkerbol 2012). Kano-based DFSS proposes to assist companies in strategically understanding VoC (Voice of Customer). In addition, there are various other methods used in this paper, namely QFD (Quality Function Deployment), FMEA (Failure Mode Effect Analysis), and DOE (Design of Experiments). All of these methods have the same basis in terms of solving problems to achieve customer satisfaction. The results obtained are a new model from the DFSS structured approach to calculate the importance of customer requirements using the Kano factor (K). Kano's model has proven to strengthen DFSS (Design for Six Sigma) and provide an innovative, efficient approach to understanding and prioritizing customer needs (George 2003). In addition, QFD helps translate customer requirements into technical requirements and prioritize them Salah, Rahim, & Carretero (2009). The development of research related to this topic has been described in detail by Khan et al. (2017), where various manufacturing and service companies have successfully implemented a combination of the three methods. Future research opportunities will demand the development of strategies that must be carried out digitally, especially in fast decision-making. The presence of industry 4.0 and society 5.0 is proof that conventional methods must adapt to technology, and humans must be able to become the control center in decision making.

3. Methods

The object of this research is a startup education company with a bootstrap category (develop independently without funding from investors). EdTech is engaged in educational services and research development using a website platform. Since 2018, the startup company has had 25,000 active users with 25 online research-class products. Data in this study collected from website user complaint data from January 1, 2020, to May 31, 2021. The complaint data will group into more general parameters or variables. The Kano model is used to classify the complaint variables into 3 (three) specifications: basic, performance, and delighter. Furthermore, top management has a selection and priority determination on the complaint variable, which will be resolved based on the company's ability. Stages in the process of improving and improving services at EdTech (Education Technology) Startup using the DMAIC (Define, Measure, Analyze, Improve, Control) methodology. The researcher chooses this methodology because the service system using a website platform already existed, so evaluation is need for continuous improvement. At the improvement stage of service quality, there is a waste analysis using the lean six sigma method so that the website access process by users becomes efficient. These improvements will be validated based on usability aspects using the System Usability Scale (SUS) questionnaire (Sauro and Lewis 2011). The website usability test involved 20 randomly selected website users.

4. Results and Discussion

In improving online class education services through the website platform, it is necessary to know the various customer complaints against using it. In this study, 774 complaints data obtain from users of the EdTech startup website for one year (January 2020 - December 31, 2020). The complaint data is then group into ten variables and four categories (mentoring quality, information clarity, time duration, and website usability) based on an assessment from the company's top management. Table 1 shows the variable and percentage complaints that can use as indicators of improvement priorities. Complaint variables that have priority are online class learning stages (35.14%), fast

response (24.29%), and payment stages (14.21%). So, the Kano method maps customer requirements into three classifications: delighter, performance, and basic. Based on the expert judgment from the company's top management, they classify two complaints variables as delighters, six complaints variables including performance, and two complaints variables classified as basic. This research will select complaint variables based on the Kano Model classification by considering the priority scale and company capabilities.

Table 1. Complaint Variable Based Kano Classification

No	Complaint Variable	Category	Percentage	Kano Classification
1	Advanced Technology-Based Learning	Mentoring Quality	1.03%	Delighter
2	Animation Education Video	Information Clarity	1.81%	
3	Setting Video Resolution (Quality)	Information Clarity	3.88%	Performance
4	Fast Response	Time Duration	24.29%	
5	Payment Stages	Time Duration	14.21%	
6	Website Design Interface	Website Usability	5.56%	
7	Online Class Learning Stages	Website Usability	35.14%	
8	Review Paper Feedback	Mentoring Quality	4.78%	
9	Access to Material Without Advertising Interference	Website Usability	5.17%	Basic
10	Learning Module Facilities	Mentoring Quality	4.13%	

**Based on 774 complaints related to education services and online classes on the website platform*

The top management will select the complaint variable to be resolved using the Six Sigma DMAIC (Define, Measure, Analyze, Improve, and Control) method. The researcher chose this methodology because the startup company's previous operational system was still acceptable, so only improvements to better services. According to Jirasukprasert et al. (2014), the primary purpose of the DMAIC methodology is to develop service products or systems that have previously increase customer satisfaction and achieve operational excellence. The application of DMAIC has also proved to be the basis for companies or organizations to make continuous improvements (Firat et al., 2017). The following are the stages of advancement and improvement of EdTech Startup services based on variable complaint data using the DMAIC methodology.

4.1 Define (D)

The first stage in the DMAIC methodology is defined: identifying problems and customer needs and determining process goals. This stage is carried out by top management because it requires a helicopter view of the startup company analysis. After obtaining the variable complaint, there is a decision to determine the variable complaint followed up. Based on expert judgment by top management, the variable complaints will follow up are variables included in the performance and basic classifications. The decision to select this variable complaint is the priority scale of the user's needs, the startup company's ability, and the duration to complete the project. The variable, including delighter, was not followed up because it took a long time and included the startup company's long-term plan. Complaint variables include basic access to material videos without advertising interference (5.17%) and the provision of material module facilities (4.13%). Both variables are classified as basic because they must follow up immediately not to interfere and increase the convenience of the learning process of website users. So, the complaint variables classified as performance are setting video resolution (3.88%), fast response (24.29%), payment stages (14.21%), website design interface (5.56%), online class learning stages (35.14%), and paper feedback (4.17%). These variables are classified as performance because when the quality of service is getting better, the satisfaction of website users will also increase. However, if analyzed in general, the priority scale is obtained based on four categories determined by the startup company, namely website usability (45.87%), time duration (38.5%), mentoring quality (8.91%), and information clarity (3.88%). Thus, there are seven variable complaints with four categories that will improve user service for the learning website platform.

4.2 Measure (M)

In knowing the startup company's performance, management must be able to define measurable and measurable goals. At the measuring stage, it aims to establish the basics of improvement and performance standards. In the previous step, seven variable complaints have four categories that will improve user service for the learning website platform. In measuring the effectiveness of improvements from improvements, it is necessary to calculate the total user complaints before and after the learning website platform repairs. In this study, we have complaint data starting from January 1, 2020, to May 31, 2021, where website repairs complete on January 1, 2021. Therefore, the researchers determined the time interval to be compared is Quarter 1 (January – March) in 2020 (before) with 2021 (after). Figure 1 shows the total user complaints in the first quarter of 2020, where it finds the highest number of complaints in the online class learning stage variable (181 complaints). The second-highest number is the complaint fast response variable related to the speed of service to answer and provide responses to website users (94 complaints). In addition, researchers have measured the usability of the website platform before repair using the System Usability Scale questionnaire (Table 3), which obtained a score of 68.25 with Grade C (OK). The score is still acceptable (minimum score of 68) but in the low acceptance stage or almost not accepted. Based on the expert judgment from top management, each complaint variable has no relationship with the other or is independent. In the complaint, other variables still do not meet the standard criteria determined by the startup company, so the company corrects all complaints.

4.3 Analyze (A)

Complaints of known variables are to improve online classroom learning education services. At this stage, each variable complaint will analyze to find out the root cause of each problem. For example, the first variable complaint is related to video resolution settings that users complain about because learning access is not smooth when the video resolution is HD quality. It is a critical problem for users with unsupported internet networks. The second variable is the fast response from the question and answer service and consultation conducted via the website. This problem occurs because of the number of admins and mentors who serve questions and answers with the increasing number of users. Another problem is that the admin or mentor must use a laptop device to access the display from the website. The third complaint variable is related to the website design interface, including color selection, appearance, and button positioning. The main problem that occurs is the position of the button placement, which is difficult to find on the website display on the cellphone. For new users, they need a clear briefing to operate the website for smooth learning. The fourth variable complaint is the online class learning stage which is considered unsystematic and less friendly. This problem occurs because of differences in perspective between the project manager and the user. The project manager assumes that access to the answers to questions is given at the end when they have learned everything. However, users want to learn and work simultaneously, so they do not get bored. There were no significant problems in the sixth and seventh variable complaints, and the startup company could follow up immediately. All of these complaint variables are complaints related to the usability of the website platform. A low usability score has also been proven with grade C, so improvements are needed to achieve optimal website usability.

4.4 Improve (I)

At the analysis stage, the main problem that causes user complaints is the website platform for learning. The next step is to improve each complaint variable to improve service and customer satisfaction from the EdTech startup company. At this stage, also consider lean for efficient use of the website. For example, variable video resolution settings can overcome by purchasing this plug-based storage system with an adjustable resolution feature, namely 240p, 360p, 480p, 720p, and 1080p. In the complaint, the fast response variable can increase by increasing admins to 2 people for question and answer services and four people for consultation via the website platform—the increase in the number linear to the number of website users and the intensity of interaction. In addition, complaints related to the website interface design will change the button buttons' position at the bottom of the display to make it easier to find buttons (without looking). It effectively eliminates the waste of customers waiting for the control, making it even more efficient. The fourth variable complaint is the online class learning stage which is followed up by adjusting the quiz feature and learning materials that can be accessed simultaneously (parallel). Furthermore, complaints of review paper feedback can resolve by making Standard Operating Procedures and determining minimum standards or criteria for review paper assessments. Finally, the complaint variables 6 and 7 can be followed up directly by the software engineer because these features are already available and can be adjusted.

Table 2. Complaint Variable Versus Improvements

No	Complaint Variable	Improvements
1	Setting Video Resolution (Quality)	Purchase a plug-in with a storage system that features adjustable video resolution to 240p, 360p, 480p, 720p, and 1080p
2	Fast Response	The addition of the number of admins to 2 people for question and answer services and four people for consultation via the website platform
3	Website Design Interface	Changed the position of the button at the bottom of the display to make it easier to find the button (without searching)
4	Online Class Learning Stages	Quiz features and learning materials can be accessed simultaneously (parallel)
5	Review Paper Feedback	Preparation of Standard Operating Procedures (SOP) and determination of standards or minimum criteria for review paper assessment
6	Access to Material Without Advertising Interference	Modification of video settings without ads on website platforms by software engineer
7	Learning Module Facilities	Addition of material module facilities for all paid class programs

In the 1st Quarter of 2021, all the improvements previously described have been completed so that the website platform enters a new evaluation stage. Researchers have collected data for total user complaints in Q1 2021 compared to Q1 2020 for all complaint variables (Figure 1). Based on these results, it can seem that the actual user complaints in Q1 2021 (after repairs) are proving to be effective in reducing the number of complaints when compared to Q1 2020 for all variable complaints. The researcher conducted a qualitative test of the website's usability on 20 randomly selected users to validate these results. The usability measurement uses the System Usability Scale (SUS) questionnaire. Before, the repair had a score of 68.25 (Grade C - OK), while the website's usability after the repair had a score of 81.75 (Grade A - Excellent).

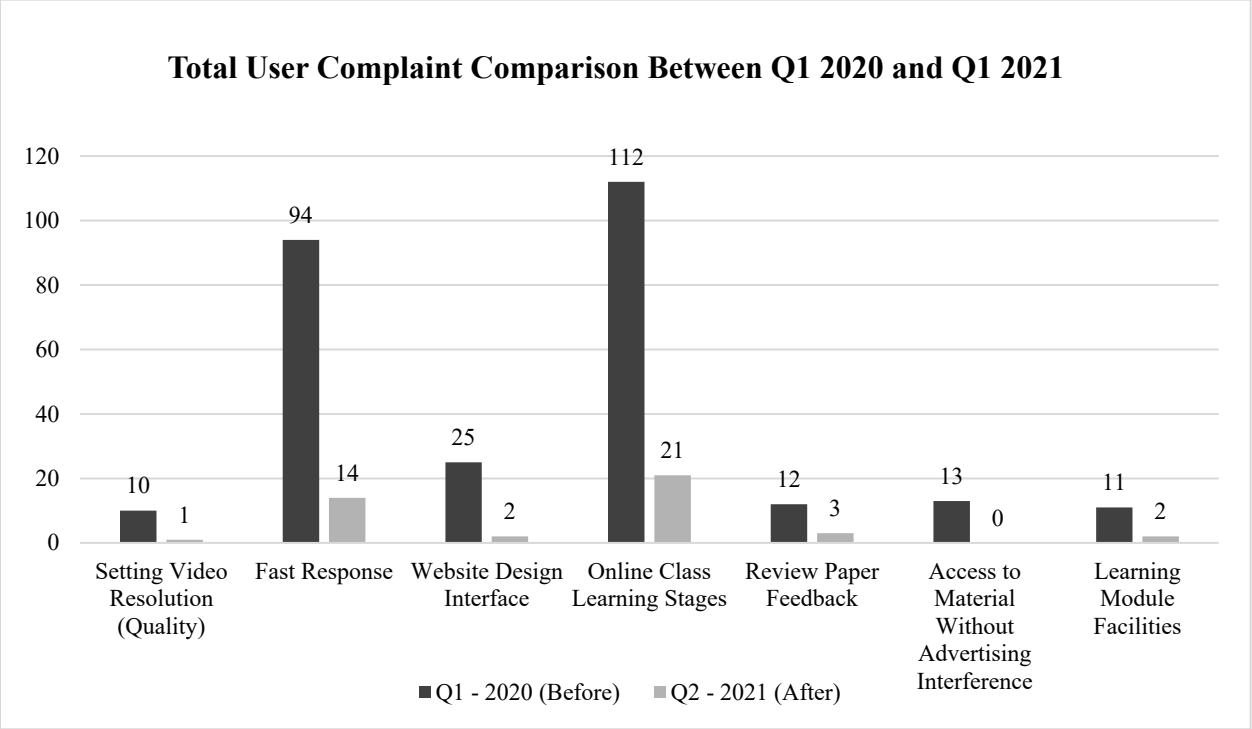

Figure 1. Total User Complaint Comparison Between Q1 2020 and Q1 2021

4.5 Control (C)

If the improvement solution has proven effective within a certain period, then the next step is to control it to measure the performance improvement (Ullah and Tamaki 2011). This stage aims to maintain repair solutions and monitor the system's success on an ongoing basis. Until now, the EdTech company used as the object of research always conducts periodic monitoring. On the website platform, contact information is available to report technical complaints when using the website. In addition, the management has provided a structured rating-based questionnaire that must be filled out by users when they have completed the learning class. With this questionnaire, the EdTech company indirectly also conducted a Voice of Customer-based survey to find out technical complaints and appreciation. Used this data for periodic monitoring; if the number of complaints has increased, the management should consider repeating the Kano Lean Six Sigma process.

6. Conclusion

The Kano Lean Six Sigma (KLSS) method is proven to improve the service quality of Education Technology (EdTech) startups based on aspects of response time duration, clarity of information, website usability, and mentoring quality. Based on the expert judgment from top management, the improvement process is select for complaint variables classified as performance and basic. Each category has a variable complaint which is a generalization of customer complaints when using the website platform. Using the Kano method, there are two complaints variables classified as delighters, six complaints variables, including performance, and two complaints variables, classified as basic. Complaint variables classified as basic are access to material videos without advertising interference (5.17%) and provision of material module facilities (4.13%). So, the complaint variables classified as performance are setting video resolution (3.88%), fast response (24.29%), payment stages (14.21%), website design interface (5.56%), classroom learning stages online (35.14%), and paper feedback (4.17%). Therefore, total user complaints in Q1 2021 (after repairs) effectively reduced the number of complaints compared to Q1 2020 for all variable complaints. As validation, there is a usability measurement using the System Usability Scale (SUS) questionnaire. Before, the repair had a score of 68.25 (Grade C - OK), while the website's usability after the repair had a score of 81.75 (Grade A - Excellent).

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Biography

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Attachments

Table 3. Total User Complaint Comparison Between Q1 2020 and Q1 2021

No	Complaint Variable	Total User Complaint	
		Q1 2020	Q1 2021
1	Setting Video Resolution (Quality)	10	1
2	Fast Response	94	14
3	Website Design Interface	25	2
4	Online Class Learning Stages	181	21
5	Review Paper Feedback	12	3
6	Access to Material Without Advertising Interference	13	0
7	Learning Module Facilities	11	2

**Q1 (January – March) 2020 : Sebelum Perbaikan, *Q1 (January – March) 2021 : Setelah Perbaikan*

Table 4. Website Usability Assessment Using System Usability Scale (SUS) Questionnaire

No	Respondents	Total SUS Score	
		Q1 2020 (Before)	Q1 2021 (After)
1	Respondent 1	75.0	95.0
2	Respondent 2	60.0	92.5
3	Respondent 3	77.5	85.0
4	Respondent 4	60.0	80.0
5	Respondent 5	70.0	92.5
6	Respondent 6	75.0	85.0
7	Respondent 7	70.0	77.5
8	Respondent 8	65.0	82.5
9	Respondent 9	62.5	77.5
10	Respondent 10	70.0	85.0
11	Respondent 11	60.0	72.5
12	Respondent 12	62.5	75.0
13	Respondent 13	72.5	80.0
14	Respondent 14	75.0	85.0
15	Respondent 15	70.0	75.0
16	Respondent 16	62.5	80.0
17	Respondent 17	62.5	82.5
18	Respondent 18	75.0	80.0
19	Respondent 19	72.5	72.5
20	Respondent 20	67.5	80.0
Average		**68.25**	**81.75**
Grade Category		**C (OK)**	**A (Excellent)**