
| RESEARCH ARTICLE

The Influence of Sex and Kanban Usage on the Productivity of Selected STEM Senior High School Students

Jullia Jessica D. Rivera¹ ✉, Jadya Samantha S. Ong², Ma. Nathalie U. Tan³, Patrick David Cenon⁴ and Wilfred Luis Clamor⁵

^{1,2,3}De La Salle University-Integrated School, Manila, Philippines

^{4,5}De La Salle University, Manila, Philippines, College of Liberal Arts, Behavioral Sciences Department, Philippines

Corresponding Author: Jullia Jessica D. Rivera, **E-mail:** jullia_rivera@dlsu.edu.ph

| ABSTRACT

Kanban is a productivity system used to help manage workflow at different stages of knowledge work in the office. This paper aims to explore Kanban's impact on the productivity among selected STEM Senior High School Students of De La Salle University Integrated School. It also examines the effects of sex and grade level on the usage of Kanban and productivity. An online survey questionnaire will be administered to a purposive sample of 70 SHS students. Data from the online survey will be subjected to data analysis using the Microsoft Excel spreadsheet program. Results show that females updated their Kanban more frequently as compared to males. The majority stated that Kanban helps them visualize their ongoing tasks. Consequently, it was seen that although female students had a higher frequency, male students had a higher perception of productivity. From this, it can be implied that higher frequency does not necessarily mean higher perceptions of productivity. In terms of frequency and GWA, from the data, there was no seen relationship between the two variables as the frequency did not affect the GWA. With that, it is recommended to examine the difference in productivity between the face-to-face and online classes to see whether the pandemic has influenced the productivity of students.

| KEYWORDS

Kanban, productivity, senior high school, sex, grade level

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1. Introduction

In a world full of dreams and aspirations, Senior High School (SHS) students are faced with the reality that "one must work for something to achieve it" (Cheng et al., 2017). Tasks such as finishing schoolwork, maintaining a social life, and having family time are only some parts of what SHS students face every day. At present, unfortunately, these constant tasks seem endless with time as they continue to add up and get more challenging every day (Pinsker, 2021). To be able to efficiently achieve these, being organized is vital. For years, numerous productivity techniques have been developed to maximize the time available to accomplish as many things as possible. Such techniques include, but are not limited to, organizing tasks, blocking time, and limiting distractions. Once an individual finds the technique most suitable for them, they will be able to do their work more efficiently. In the context of SHS students, it is vital to develop routines and study habits both to comply with all the deadlines given to them every day and to manage such problems they deal with outside of academics.

There are many ways for students to organize their everyday lives, one of which is the Kanban Productivity Technique, a work scheduling system that aids in the visualization of tasks to increase productivity and avoid idle time. It is a methodology pioneered by Taiichi Ohno, the father of the Toyota Production System, to improve the process and resolve the inefficiencies in their production (Kanawade et al., 2020). As students function in a competitive environment, it would be beneficial to seek competitive advantage by amplifying flexibility, quick response, and quality of work. Applying this system into their routines will reduce the waste of their resources from overproduction and unnecessary motion as they visualize tasks, limit the work in process, focus on

the flow, and continue the improvement (Raut et al., 2015). The Kanban Method is recognized not just as a methodology; it is also a philosophy that intends to enhance processes by continuously ensuring waste reduction (Raut et al., 2015).

Many factors may affect the results of implementing the use of productivity techniques such as Kanban, one of which is the sex of the person using it. In the branch of education, a possible measure for productivity is through the number of researches published (Leahey, 2006). From the study done by Lone & Hossain (2007), there was a seen gap between the research productivity of men and women due to their specific societal roles. Men were seen to have more time to focus on their research and career path since they did not have specific familial responsibilities. Due to the women's usual role of taking care of the family, they have less time for their personal careers as compared to men (Leahey, 2006; Lone & Hossain, 2007). On the contrary, Mayer & Rathman (2018) did not find a difference between the productivity of males and females in terms of research publications. In their study, it was found that there are no statistical correlations between the sex of the user and their productivity. Although these studies present numerous possibilities of the relationship between the two variables, it is best to further question and explore whether or not these variables affect one another.

Currently, the COVID-19 pandemic has heavily impacted the way people do their work. For students, it has challenged them to do all their usual activities in the confinement of their own homes. But, because one's home is a private place for rest, relaxation, and family time, school work initially done with friends at school proves to be a challenge. The line between school and home becomes unclear and causes a possible lack of motivation to accomplish the given tasks. Not to mention, the lack of social interaction and increase in self-isolation may also cause certain students to experience significant decreases in their mental headspaces, leading to stress and other mental disorders. Such drastic changes in their routine and schedule cause them to experience a great shock in terms of academics (Cenon et al., 2020). For SHS students, adjusting to a university setting would be difficult due to the new school environment. In the time of a pandemic, however, establishing productivity routines and habits becomes an extra challenge. Fortunately, the presence of productivity techniques can help students cope by helping them establish productive routines and habits to resist self-interruptions and distractions. Nevertheless, only limited research has been done on the use of these techniques during the pandemic and how they may impact one's productivity.

For Kanban specifically, some research has been done with regards to its effect on productivity in the workplace. Many reputable sources have revealed the vital role of Kanban in increasing work efficiency, especially in manufacturing businesses. For instance, in an article written by Adnan et al. (2013; as cited in Sharma et al., 2019), Kanban has been proven to significantly reduce overproduction in businesses, thus causing lesser lead times between tasks and an overall reduced total cost. Furthermore, due to the very simple and straight-to-the-point manner of the technique, it has also been found to have other positive effects on a workplace's overall productivity, such as better communication and immediate responses to changes in demand (Mayilsamy and Pawan, 2014; as cited in Sharma et al., 2019). On the other hand, some workplaces that also utilized Kanban resorted to adjusting it according to their businesses' needs. This can include combining it with another technique, creating another technique that is adopted from Kanban, and others. In doing so, they were able to achieve an overall improvement in the productivity of their workplace system as a whole (Braglia, 2019; Sharma et al., 2019). Having said all of this, the researchers recognized that only a finite number of articles had been written about the effects of Kanban on productivity amongst students specifically.

With the sudden adjustment to an online distance learning setup, it is no surprise that a majority of SHS students struggled to adjust their study habits and routines to fit with the new environment. This research aims to examine the usage and effectiveness of Kanban among SHS students. It will analyze the sex of students to see whether it influences the frequency of updating Kanban pages. In addition, the research also aims to investigate whether the frequent updating of Kanban increases student productivity.

1.1 Research Questions

1. Does the sex of SHS students affect the frequency of updating their Kanban?
2. Does the higher frequency of updating Kanban lead to higher perceptions of productivity?
3. Does the higher frequency in updating Kanban lead to a higher General Weighted Average (GWA)?

1.2 Research Hypothesis

1. Sex and Frequency of Kanban Use
H₀: There is no significant difference between the frequency of male and female SHS students when updating their Kanban.
H₁: There is a significant difference between the frequency of male and female SHS students when updating their Kanban.
2. Frequency of Kanban Use and Productivity
H₀: The frequency of updating Kanban does not influence the perception of the productivity of SHS students.

H₂: The frequency of updating Kanban influences the perception of the productivity of SHS students.

3. Frequency of Kanban Use and Grades

H₀: The frequency of updating Kanban of SHS students does not influence their General Weighted Average (GWA).

H₃: The frequency of updating Kanban of SHS students influences their General Weighted Average (GWA).

1.3 Scope and Limitations

This research was limited to examining the influence of the sex to the frequency of students when updating their Kanban. In addition, it also investigated the influence of the frequency of updating Kanban on the perception of productivity and grades.

The participants of this study were limited to Science, Technology, Engineering, and Mathematics (STEM) SHS students from the De La Salle University Integrated School-Manila (DLSU-IS Manila) who were current Kanban users. Non-Kanban users, non-STEM SHS students, and non-DLSU-IS Manila students were all excluded from this study.

1.4 Significance of the Study

The COVID-19 pandemic has caused challenges among SHS students. With this crisis, it is crucial to discover new techniques to help SHS students remain productive despite challenging conditions caused by the pandemic. Despite its limitations, the research makes a contribution by providing literature about the use of productivity techniques during a pandemic. The knowledge gained can be used to improve the academic performance of SHS students. Considering that studies on productivity among SHS students during the pandemic are scarce and limited.

1.5 Definition of Terms

Term	Definition
SHS	Senior High School Grade 11 and 12
Kanban	System of organization developed by Taiichi Ohno of Toyota Development System
Productivity	The measurement of output per unit of input in a given amount of time.
Sex	Reproductive system and sexual orientation assigned to humans at birth.
STEM	Science, Technology, Engineering, and Mathematics Strand
COVID-19	Coronavirus disease
GWA	General Weighted Average

2. Literature Review

2.1 Kanban

Producing quality work and finishing them on time can be a struggle for some people. To solve this, people try to learn new strategies or styles to maximize their time to accomplish the tasks assigned to them that day. Several methods have been developed in order to increase productivity. One of these is Kanban.

Kanban, from the Japanese word meaning ‘cards,’ is a methodology developed by Taiichi Ohno of the Toyota Development System to ensure workflow and productivity in the factory. In 1969, Ohno realized that there were inefficiencies in the factory; therefore, they looked for ways to resolve them (Kanawade et al., 2020). One of the possible solutions to this was to implement a card system within the workspace. At that time, a three-bin system was implemented wherein bins could be found on the factory floor, factory store, and at the supplier (Raut et al., 2015). These bins contained cards holding information and details about the products. Whenever these bins would become empty, the supplier would replace them with a full bin containing a card. This continuous system ensured that the production line would never run out of the materials they needed.

Through this system, they were able to eliminate the time spent on transportation, materials, and defects (Raut et al., 2015). According to studies, this increases productivity because the flow of information from the different departments allows them to lessen the unused time by forecasting the problems that they may encounter in the future (Karlsson & Norr, 1994). They were also able to develop routines in time of set-up and development of the products they are manufacturing.

From the context of movement in the factory, this methodology was then brought to an office set-up using a Kanban table and post-its. Instead of the order and supply, this method is used to depict the workflow and different stages of manufacturing or knowledge work in the office (Kanawade et al., 2020). The table is divided into columns of “to-do”, “doing”, and “done,” and tasks are moved horizontally for everyone to see the progress. It is seen to be effective because, visually, workers can see the progress of each task and prevent delaying work by ensuring it is done immediately. Studies then concluded that the Kanban methodology saved time and ensured efficiency in their own workspaces, therefore increasing productivity (Karlsson & Norr, 1994; Raut et al., 2015).

2.2 Productivity

Relative productivity is the measurement of the amount of work done per unit of time or day. Interpreting productivity, on the other hand, depends on which aspect one measures. As per definition, one can see productivity based on the input and output of the subject. An easy analogy is in production, where the number of products is measured given the materials and time it took to produce the result.

In education, productivity cannot be quantified due to the numerous factors and characteristics that can affect it (Levin, 2003). Variables such as time, personal background, and school are subjective, so a fair comparison would be difficult. A possible example of input in education is the students. When students start K-12, they come in without knowledge, or per se, a blank slate. Through the education system, they are expected to come out with a certain amount of information after finishing 12th grade (Ettema & Hanushek, 2017). In the study by Levin (2003), he considered the students being the workers and processors of the input. There he saw the input as the data given by the teachers and the experiences students go through in the process of completing their education. Conversely, the output would be how they are to translate this information and knowledge into the real world. Although this is feasible, fair judgment between outputs is also subjective.

Another indicator of productivity is research. It is relatively common in universities for undergraduate and doctorate students to write several papers during their time in the university. In this aspect, productivity can be measured by the number of publications done by the student (Stack, 2003). On the other hand, Leahey (2006) believes that research papers are just one of the indicators of productivity in education. Consequently, researchers still use research papers to measure the productivity of students, universities, and research facilities. However, given the conditions where students do not have control over what they write and are, rather, imposed by the curriculum, the researchers do not see this as an indicator of productivity.

2.3 Sex in Research Productivity

Opportunities given to people are sometimes dependent on who they are, what they have finished, or where they have come from. This is also visible in research, where gender also defines which types of publications are more lenient in placing one's work in their journals. Several studies have been conducted to measure which gender is most likely to publish more articles per year.

In the study done by Lone & Hossain (2017), they found that men are proved to have better productivity than women. Some factors that affect women's productivity are marriage and domestic workload. Women are commonly relied on for pregnancy and child-rearing, therefore, taking much of their free time. Conversely, men are more productive full time during their career, therefore, receiving more funding and support from research facilities.

Being able to conduct research also comes with specialization in a given field or topic. Studies suggest that women are also less likely to specialize than men (Leahey, 2006). Because of this, significant data suggest that women publish fewer articles than men, proving the stand of other researchers (Leahey, 2006; Lone & Hossain, 2007). On the other hand, Mayer & Rattman (2018) found no significant difference in the research productivity of men and women in non-prestigious books. Through statistical tests, they proved that sex alone is not directly related to productivity in research.

Most studies confirm that men are most likely to be more productive than women due to the several factors that affect them. Nonetheless, movements promoting equal opportunity have weakened these stereotypes. Slowly but surely, equality may be realized in the field of research.

2.4 Synthesis

The review conducted shows the different aspects of productivity. Studies show that although first used in a factory setting, Kanban, when brought to an office, was proved to be just as efficient (Karlsson & Norr, 1994; Raut et al., 2015). With that, Kanban may be optimized in a classroom setting and is, therefore, why such a system will be used in this study.

In defining productivity in education, a number of studies solely relied on the number of published research in a year. Although some would only consider it as a factor that suggests productivity, some researchers use it to interpret the productivity of students, schools, and research facilities. Due to the conditions where the number of research papers required of SHS students is predetermined by the curriculum, the researchers have decided that this would not be used as a measure of productivity. Instead, the researchers will use the student's perception of productivity and their actual General Weighted Average (GWA).

In the case of sex, research has shown that men tend to be more productive than women due to the factors present in their surroundings (Leahey, 2006; Lone & Hossain, 2007). These factors can be seen in their responsibilities as parents or their lack of opportunities. While studies suggest the inferiority of women to men in research, the researchers are inclined to promote social equality in SHS, where researchers believe that there should be no difference in productivity.

3. Methodology

3.1 Materials

In order to determine the influence of the independent variables (i.e., sex) on the dependent variables (i.e., perceived levels of productivity and GWA), the researchers are to execute the following activities. It will follow the research plan below.

3.1.1. Research Plan

Activity	2021					2022			
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	March	Apr
Development of Survey Questionnaire	X	X							
Data Collection			X	X	X	X	X		
Data Analysis								X	X

3.2 Sampling Method

Purposive sampling will be used in this study to obtain qualified respondents for the survey.-The target respondents are Grade 11 and 12 STEM students from DLSU-IS Manila who use the Kanban technique in their academic routine and study habits. The survey will be conducted from October 2021 to February 2022 using Gmail and Google Forms. Students from other strands (i.e., ABM, HUMSS, ADT, SPT) and those who do not use the Kanban technique will be excluded from this study. The survey will be limited to 160 respondents due to limitations in time and human resources.

3.3 Development of Survey Questionnaire

The survey is composed of three parts, 1) Profile of Respondents, 2) Frequency of Kanban Use, and 3) Productivity. It is important to note that Part 3 Productivity was adapted from Voulle (2011), who aimed to determine an individual's perception of their productivity. The researchers will use a five-point Likert scale to measure survey statements related to one's perception of productivity. In addition to these questions, the General Weighted Average (GWA) of the respondent will be obtained. In compliance with ethical requirements, parental consent for underaged students will be collected from the respondent's profile. Pre-testing will be conducted on 15 STEM students of DLSU-IS Manila to validate the questionnaire and eliminate errors. (See Appendix A).

3.4 Data Analysis

The data acquired from the questionnaire shall be organized using Microsoft Excel. This software will then be used to format and calculate data in order to analyze hypotheses H1 to H3.

3.4.1 Data Analysis Matrix

Independent Variable	Type of Data	Dependent Variable	Type of Data
Sex	Nominal	Frequency of Kanban Use	Interval
Frequency of Kanban Use	Interval	Perceived Levels of Productivity	Interval
Frequency of Kanban Use	Interval	GWA	Interval

4. Results and Discussion

This chapter presents all the data gathered after the distribution of the survey questionnaire. It will also involve a comprehensive discussion of the derived results.

4.1 Profile of Respondents

Table 1
Profile of Respondents

		f	%	Mean	Range
Gender	Male	34	50%	-	-
	Female	34	50%	-	-
Grade Level	Grade 11	13	19.1%	-	-
	Grade 12	55	80.9%	-	-
Length of Using Kanban (months)		-	-	13.54	0-60

Given the limitations caused by the pandemic, the researchers were only able to accumulate a total of sixty-eight (68) responses, thirty-four (34) male and thirty-four (34) female. Among these, only thirteen (13) were Grade 11 students, while the other fifty-five (55) were Grade 12 students. The uneven distribution of participants per grade level led to the reconsideration and eventual inconsideration of grade level as a variable in the research. Meanwhile, for the length of using Kanban, the participants had a mean length of 13.54 months, or in more layman’s terms, a year and a month of experience in using the technique. The range of Kanban usage among the participants ranged from 0 months to at most sixty (60) months or five (5) years.

4.2 Kanban Use

Table 2
Kanban Use of Respondents

		f	%	Mean	Range
Reasons for Kanban Use	Kanban motivates me to accomplish my tasks before their indicated deadline.	44	64.7%	-	-
	Kanban helps me visualize everything I still need to do.	60	88.2%	-	-
	Kanban prevents me from procrastinating.	35	51.47%	-	-
	Kanban helps me organize what to do on a day-to-day basis.	59	86.76%	-	-
Frequency of use		-	-	4.37	1-7

To better comprehend the statistics, the researchers decided to integrate a set of possible reasons in the survey as to why the participants possibly use Kanban. A total of 3 reasons were indicated, as shown on the table, and the participants were asked to select all that apply to them. After data gathering, it can be observed that among the 68 respondents, around 64.7% resonated with the first reason. Amongst the same set of students, the most (60) agreed with the second reason, this being around 88.2% of the respondents. Meanwhile, the least number of students (35) agreed with the third reason, with only a little over half (51.47%) selecting it. Lastly, around 86.76% of the respondents resonated with the final reason, this being only 1 student less than the second reason.

For the quantitative aspect of the respondents’ Kanban Use, the researchers decided to ask the respondents to indicate how often they update their Kanban in the span of a week. For this specific question, they were given 7 numerical values to choose from, these being 1, 2, 3, 4, 5, 6, and 7 and above. Furthermore, prior to conducting the data gathering, the researchers established that respondents who stated that they update their Kanban 1-4 times a week would be considered light users, while those who stated that they update their Kanban 5 times and above would be considered light users. After collecting data, it can be observed that the mean score of Kanban Usage was 4.37, meaning that the respondents, on average, fit into the profile of light users.

Table 3
Difference of Reasons for Kanban Use Between Male and Female

	Male f, %	Female f, %
Kanban motivates me to accomplish my tasks before their indicated deadline.	18, 52.94%	27, 79.41%
Kanban helps me visualize everything I still need to do.	29, 85.29%	32, 94.12%
Kanban prevents me from procrastinating.	16, 47.06%	20, 58.82%
Kanban helps me organize what to do on a day-to-day basis.	28, 82.35%	32, 94.12%

For further analysis in-line with our hypothesis, the results for reasons of Kanban Use in *Table 2* were segregated into 2 categories based on their given sex. After making such segregation, it can be seen that a significantly higher number of female respondents agreed with the first reason in comparison to male respondents, with the number being 27 and 18, respectively. This infers that around 79.41% of the female respondents agreed with the first reason, while only around 52.94% of the male respondents agreed with it. For the second reason, around 94.12% of the female respondents (32) resonated with the choice, while around 85.29% of the male respondents (29) resonated with it, making their number lesser than that of the females once again. As for the third reason, only 20 female respondents (58.82%) agreed, making it the least agreed reason for the female respondents. The same applies to the male respondents, with only 16 (47.06%) agreeing with the reason. Finally, for the last reason, the same amount of female respondents agreed with the statement as with the second reason (94.12%). As for the male respondents, 28 had selected and agreed with the statement (82.35%).

Table 4
Difference of the Frequency and GWA of Female and Male Students

	Male		Female	
	Mean	Range	Mean	Range
Frequency of Use	3.94	1-7	5	1-7
Grade Weight Average	94.55	88.8 - 98	95.24	90.41 - 99.03

In *Table 4*, the results from Frequency of Use in *Table 2* were also segregated into male and female respondents, similar to *Table 3*. It can be seen here that the mean frequency of use for the female respondents is higher than that of the male respondents, with their averages being 5 times a week and 3.94 times a week, respectively.

To objectively measure the productivity of the said respondents, the researchers also decided to ask for the students' General Weighted Average (GWA). This was to gauge whether their frequency of use had a positive, negative, or no effect on their numerical grades. After collecting such, it can be observed that the female respondents obtained a higher average GWA (95.24) than the male respondents (94.55). Among the respondents, it can also be observed that the lowest inputted GWA was 88.8 for male respondents, while for female respondents, 90.41 was the lowest. On the other hand, the highest GWA for male respondents was 98, while for females, 99.03 was the highest GWA.

These preliminary findings show that there is a possible case to be made about the relationship between one's frequency of use and one's GWA. Nevertheless, further research is needed to better analyze other possible factors which could also be considered in the equation.

4.3 Productivity

Table 5
Productivity Questionnaire Results

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	SD
Q1. My productivity has improved while using Kanban.	1	1	7	46	13	4.01	0.70
Q2. I have been able to increase the output of my school work when using Kanban.	1	2	17	33	15	3.87	0.84
Q3. My school work has become more efficient when using Kanban.	1	0	10	39	18	4.01	0.74
Overall Productivity Score	-	-	-	-	-	3.99	0.69

To measure the perception of productivity of the students, a productivity questionnaire was adapted from a previous study and was presented through a Likert scale. With that, three specific statements were used to measure the perception of productivity. These statements included the improvement of productivity, the increase of output due to productivity, and finally, the efficiency of completing school work. From this, the researchers averaged the respondents' scores to come up with their overall productivity scores. With a total of 68 respondents, the total overview of their productivity score is tallied as presented in Table 5. For the first statement regarding one's productivity, a majority (46) agreed that their productivity had improved while utilizing the technique. The respondents measured an overall mean score of 4.01 or agreed for this section. Next, in terms of the increase in output for schoolwork, thirty-three (33) respondents agreed that they had more outputs when using Kanban, while seventeen (17) remained neutral. This gives a mean score of 3.87, which can be interpreted as neutral, but when rounded-off would lean more towards agree. Finally, for efficiency, thirty-nine (39) respondents agreed that Kanban has helped them be more efficient. This has a percentage of 57%, which gives out an overall mean of 4.01 or agreed in this aspect. All in all, the respondents had an average productivity score of 3.99, which can be used to infer that Kanban helped the SHS students be productive.

Given these results, it can be seen that overall, the Kanban Productivity Technique does aid in the increase of the perception of productivity among Senior High School students. This can be highlighted especially in the improvement of productivity due to Kanban, which refers to overall productivity within the person, not only in school work. It can be perceived that the students have also applied this in their extra-curricular works and personal lives. These results show a similar outcome to the study done by Karlsson & Norr (1984), where they have also seen Kanban has helped increase productivity. On the contrary, the next statement, which is the increase of output of school work, did not have a similarly high score as the other two statements. The mean, however, still proves that generally, they still agree that the productivity technique influences the completion of their school-related tasks.

Table 6
Comparison of Productivity Score between Male and Female Students

	Male		Female	
	Mean	SD	Mean	SD
Q1. My productivity has improved while using Kanban.	4.06	0.60	3.97	0.80
Q2. I have been able to increase the output of my school work when using Kanban.	3.97	0.72	3.76	0.96
Q3. My school work has become more efficient when using Kanban.	4.09	0.67	4.06	0.81
Overall Productivity Score	4.02	0.57	3.93	0.79
GWA	94.55	2.37	95.25	1.87

Consequently, the scores between the two different sexes are separated to review if this variable influences the perception of productivity through Kanban Use. With that, the comparison between the productivity scores is presented in Table 6. In the aspect

of improvement of productivity, the male participants had a higher score (4.06) as compared to the female participants (3.97), which had a very small margin of 0.09. For the next statement, which talks about the output of school work, male participants again had a higher score of 3.97 while the female participants measured a score of 3.76. Finally, for the efficiency of doing school work due to Kanban, the male participants recorded a score of 4.09 as compared to the score of 4.06 of the female participants, which is only a difference of 0.03. Looking at the overall productivity score, the male participants have a measure of 4.09 while the females have a lower score of 3.93.

From this data, it can be concluded that the male respondents have a higher perception of productivity as compared to the women. Although there is only a small difference, the males have a higher score in all aspects of productivity. In terms of the GWA, however, the female participants receive a higher average for their grades. These results may imply that despite the perception of productivity being higher for males, their grades do not reflect such. For the females, on the other hand, although their perception may be lower, their performance is better.

So, the data shows that the frequency of updating Kanban does not necessarily affect the productivity score of students directly. This is due to the men showing a higher productivity score as compared to women even though they have a higher frequency of updating their Kanban boards. On the contrary, this may also imply that using the Kanban technique can give the feeling of being more productive even though one is not really being productive.

5. Conclusion

As stated in the results above, the female respondents update their Kanban an average of 5 times a week, which is 1.06 times more than the male respondents, who update 3.94 times a week. With such a result, it can be inferred that the majority of the female respondents can be categorized as heavy users, while most of the male respondents can be categorized as light users. Due to this, the first hypothesis is proven true, which states that there is a significant difference between the frequency of male and female SHS students updating their Kanban.

Based on the overall productivity scores, the use of the Kanban Productivity Technique yields a positive increase in the perception of productivity of the SHS students. The majority of the respondents agree that their productivity improved, the amount of academic output increased, and work became more efficient when using the technique. The male respondents have a superior perception of productivity as compared with the female respondents, which is reflected through their higher scores on all the measures of the productivity provided in the questionnaire. Overall, these results support the second hypothesis, which states that the frequency of updating Kanban influences the perception of productivity of SHS students.

The average GWA of male and female respondents are 94.55% and 95.25%, respectively. Despite having a lower score in their perception of productivity, the female respondents produced a higher GWA as compared to the male respondents. Regardless of the lower frequency of Kanban usage, the average GWA of the male respondents does not significantly differ from the female students by having a minor difference of 0.7%. It is concluded that the third hypothesis is proven false because the frequency of updating Kanban of SHS students does not influence their General Weighted Average (GWA).

It is recommended that the succeeding researchers would conduct a comparative study on students' productivity between traditional face-to-face classes and online distance learning when using the Kanban Productivity Technique. This recommendation should be made to determine the severity of the pandemic's effect on the students' performance and Kanban usage and to widen the scope of data gathering by administering the survey both online and offline. The succeeding researchers may also conduct another experiment with a new set of productivity techniques from respondents of different academic levels.

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References

- [1] Braglia, G. R., & Marrazzini, L. (2020). Rolling Kanban: a new visual tool to schedule family batch manufacturing processes with kanban. *International Journal of Production Research*, 58(13), 3998–4014. <https://doi.org/10.1080/00207543.2019.1639224>
- [2] Cheng, Z., Li, J., Sun, G., Wang, W., & Zhang, X. A. (2017). Achievement goals and life satisfaction: the mediating role of perception of successful agency and the moderating role of emotion reappraisal. *Psicologia: Reflexão e Crítica*, 30(1). <https://doi.org/10.1186/s41155-017-0078-4>
- [3] Delprato, M., & Antequera, G. (2021). School efficiency in low and middle-income countries: An analysis based on PISA for development learning survey. *International Journal of Educational Development*, 80, 102296. <https://doi.org/10.1016/j.ijedudev.2020.102296>
- [4] Hanushek, E. A., & Ettema, E. (2017). Defining Productivity in Education: Issues and Illustrations. *The American Economist*, 62(2), 165–183. <https://doi.org/10.1177/0569434516688207>
- [5] Kanawade, C. S., Khedekar, D. R., Prasad, S. R., Pawar, P. S., & Thakare, V. P. (2020). *Implementation of Kanban System*. 7(4), 7.
- [6] Karlsson, C., & Norr, C. (1994). Total Effectiveness in a Just-in-Time System. *International Journal of Operations & Production Management*, 14(3), 46–65. <https://doi.org/10.1108/01443579410058522>
- [7] Leahey, E. (2006). Gender Differences in Productivity: Research Specialization as a Missing Link. *Gender and Society*, 20(6), 754–780.
- [8] Levin, B. (1993). Students and Educational Productivity. *Education Policy Analysis Archives*, 1, 5. <https://doi.org/10.14507/epaa.v1n5.1993>
- [9] Lone, F. A., & Hossain, M. (2007). Gender Variations in Research Productivity: Insights from Scholarly Research. 13.
- [10] Mayer, S. J., & Rathmann, J. M. K. (2018). How does research productivity relate to gender? Analyzing gender differences for multiple publication dimensions. *Scientometrics*, 117(3), 1663–1693. <https://doi.org/10.1007/s11192-018-2933-1>
- [11] Pinsky, J. (2021, January 15). *Why Your To-Do List Never Ends*. The Atlantic. <https://www.theatlantic.com/family/archive/2021/01/to-do-list-tasks-never-end/617674/>
- [12] Raut, L., Wakode, R., & Talmale, Pr. (n.d.). Overview of Kanban Methodology and Its Implementation. 3(02), 4. <https://doi.org/03.2518-2521>
- [13] Sachin K S. & Vikas S. (2019). The Effects of Implementation of Kanban System on Productivity: A Case Study of Auto Parts Company. *ICFAI Journal of Operations Management*, 18(1), 56–68.
- [14] Stack, S. (2003). RESEARCH PRODUCTIVITY AND STUDENT EVALUATION OF TEACHING IN SOCIAL SCIENCE CLASSES: A Research Note. *Research in Higher Education*, 44(5), 539–556. <https://doi.org/10.1023/A:1025439224590>