ORIGINAL ARTICLE

GRAPHICAL VS. NONGRAPHICAL DISPLAYS: WHICH ONE IS THE BEST LABELING SYSTEM FOR LABORATORY SEARCHING TASK?

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ABSTRACT

Graphical displays are known to improve the process of obtaining information because it can be easily comprehended. It also can be recognized faster and more precisely compared to nongraphical (i.e. alphanumerical) displays. However, it is unknown if the graphical displays application in labeling systems can improve the human performance in searching tasks in general, more particularly, on reducing the completion time of searching tasks and minimizing the errors made during the laboratory searching task. The objectives of the study are: (i) to evaluate the effect of graphical displays on the completion time of searching tasks; and (ii) to evaluate the effect of graphical displays on the errors made during searching tasks. Thirty-two participants (M= 21.875 years old; SD = 1.453) were recruited for the study, and assigned evenly to either the Graphical or the NonGraphical group. Participants were instructed to search for a total of sixteen items in a laboratory, and the completion time and errors made by him or her were recorded. The findings show that: (i) in term of completion time, there was a significant difference in the performance for Graphical group (M = 743.59, SD = 103.57) and NonGraphical group (M = 985.26, SD = 345.50) conditions; t (16) =2.680, p =0.015; and (ii) in term of the errors made, there was a significant difference in the performance for Graphical group (M = 0.19, SD = 0.544) and NonGraphical group (M = 1.13, SD = 1.360) conditions; t (16) =2.560, p =0.019. The results show that graphical displays is the best labeling system for laboratory searching task for both dependent variables being evaluated. The results from this study provide additional information regarding the application of graphical displays on human performance in general, and more specifically, recommend a better and suitable display type of labeling system - which is, one of the attributes of 5S system - for searching tasks.

***Keywords**: Graphical Displays, Searching Task, Labeling System, Completion Time, Human Error*

INTRODUCTION

Displays Ergonomics is one of the branches in Ergonomics. This topic in Ergonomics deals with how well humans receive and process information of a design for optimum safety, health, and performance. Displays Ergonomics can be classified into five categories – alphanumerical, graphical, representational, quantitative, and qualitative ((Bridger, 2008); (Tayyari & Smith, 1997); (Sanders & McCormick, 1993)).

The current study focuses on the graphical displays which typically involve graphical representation. In other words, this type of display uses a graphic or picture to transfer information (or input) to users. There are several attributes that need to be considered in designing optimum graphical displays. These include the size, color, symbol, context, and associated text ((Bridger, 2008); (Tayyari & Smith, 1997); (Sanders & McCormick, 1993)). The choice of the graphical displays need to be appropriately designed so that it will interact with users effectively. In addition, graphical displays also need to be used in the right context so that it will not confuse the users. Moreover, using the alphanumerical or graphical displays alone (i.e. alphabet/number or picture alone) would require a longer time for the users to perceive the transferred information ((Bridger, 2008); (Tayyari & Smith, 1997); (Sanders & McCormick, 1993)). Thus, an associated text normally accompanies the picture in designing the best graphical displays to optimize the interaction between the design and the human ((Bridger, 2008); (Tayyari & Smith, 1997); (Sanders & McCormick, 1993)).

Graphical displays can improve the process of obtaining information through experiences, thoughts, and senses by enhancing the ability of the human visual system to see patterns and images (Heer, Bostock, & Ogievetsky, 2010). In addition, graphical displays can also be a universal language and easily comprehended (Norman, 1991). According to Smiciklas, 2012, about 50% of the brain is responsive directly and indirectly to visual stimuli. In addition, Smiciklas (2012) also found that symbols or graphical elements can be recognized faster and more precisely compared to text. Literature suggests that graphical displays can optimize the

interaction between humans and the design effectively.

In a workplace setting, the 5S application is known as a basic lean approach for system improvement ((Kanamori, et al., 2017); (Milosevic, et al., 2013)). The advantage of the 5S system is that it can increase the work efficiency and minimize error ((Singh & Ahuja, 2014); (Khamis, et al., 2009)). Among the tasks involve in a workplace setting is searching for an item. In 5S system, '*seiton*' (or 'set in order') is defined as the arrangement of necessary items into a systematical and neat order so that they can be easily selected (or found) for use ((Khamis, et al., 2009); (Tsuchiya, 1999)). This principle (i.e. *seiton*) is important because people tend to forget the location of an item (Mizuho, Koji, & Itiro, 2011), which will result in a longer searching time that could affect overall production time (Mahzan & Hassan, 2015). According to Singh & Ahuja, (2014), approximately 30% reduction in item searching time can be obtained if the *seiton* principle is applied appropriately. Thus, the application of the *seiton* is very important.

As mentioned earlier, people tend to forget the location of an item (Mizuho, Koji, & Itiro, 2011). This is especially true if the user is trying to find the item for the first time. In *seiton* phase, choosing the optimal labeling method for a system is crucial to minimize the completion time of the searching tasks. In addition, unfamiliarity with the item to be searched can result in human error where people possibly will pick a wrong item. Currently, the 5S' labeling system that is commonly used as an indicator in locating an item is the alphanumerical display (alphabets and numbers only). As the graphical displays can improve the process of obtaining information compared to alphanumerical displays ((Bridger, 2008); (Tayyari & Smith, 1997); (Sanders & McCormick, 1993)), thus, it is plausible that incorporating graphical displays into the labeling system could improve the process of finding an item. However, it is unknown if the graphical displays can improve human performance in searching tasks in general.

The aim of this project is to evaluate the effect of graphical displays on the human performance during searching tasks of laboratory items. In order to achieve the aim, the following objectives were identified: (i) to evaluate the effect of graphical displays on the completion time of searching tasks; and (ii) to evaluate the effect of graphical displays on the errors made during searching tasks.

METHODS

Participants

Thirty-two participants between 20-28 years of age (mean = 21.875; SD = 1.453) completed the study. They are undergraduate students from Faculty of Engineering at the International Islamic University Malaysia (IIUM). Only engineering students were considered in this study so that they have a similar familiarity in recognizing the items being used in the experiment. In addition, postgraduate students were also excluded in this experiment for the same reason – to control the level of familiarity among participants. Ethnic background, first language, and minority status were not considered in the study.

Apparatus and Stimuli

The laboratory used for the study was the Polymer Laboratory at the Faculty of Engineering, IIUM.

Laboratory with the Current System Setup (nongraphical displays system): The current labeling system used at the Polymer Laboratory is the nongraphical displays system (i.e. alphanumerical displays – in which, the items or items' location was labelled using the alphabets and numbers only – e.g. refer to Figure 1). Thus, no changes were made to the labeling system of the laboratory in evaluating the nongraphical displays system (i.e. current system).

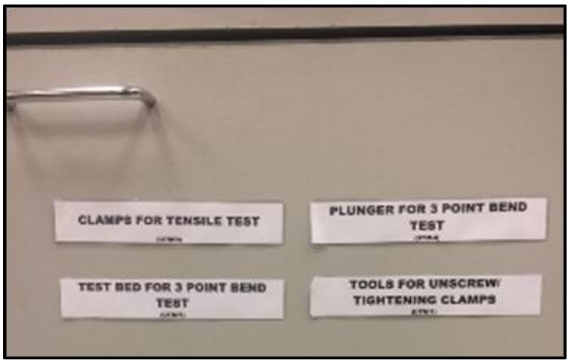

Figure 1: Current Labeling System – NonGraphical (alphanumerical)

Laboratory with the New System Setup (graphical displays system): To evaluate a labeling system with graphical application, the labeling system of the Polymer Laboratory was redesigned by incorporating the use of pictures or images of the item in labeling the items or items' location – e.g. refer to Figure 2.

Figure 2: New Labeling System - Graphical

In redesigning the new labeling system, photos of the 150 items inside the Polymer Laboratory were taken (items that are labelled in the current system). The photos were then incorporated with its associated text. The new labeling system – graphical displays with its associated text – was then placed accordingly (i.e. posted the label at the same location of the current system) during evaluation of the new system. For machines, it was posted on the machine itself. For other categories – machinery accessories, safety equipment, and lab apparatus – the graphical displays were posted on the drawer's door that contained the item.

Search Card: During the experiment, sixteen cards containing the name of one item to be searched was shown to participants – one by one. Thus, in total, sixteen cards were prepared in which each card contains the name of one item.

Stopwatch App: A stopwatch app was used to measure the completion time of the searching task. A common stopwatch application of a cellphone was used for this purpose. Basically, to start the timing, a start button of the app was pressed, and the same button was pressed to stop the timing.

Informed Consent Form: Basically, consent form provides participant with information about the experiment (without jeopardizing the objective of the experiment) so that he or she can make an informed decision about participating. The form was also used to explain the general idea of the experiment to the participants. The crucial elements included in the form were: (i) the procedures; (ii) the potential risk if any; (iii) benefits of the involvement; (iv) the confidentiality statement of the experiment; (v) the voluntary statement; and (vi) the agreement between the researcher and participant.

Participant Data Form: The participant data form consists of the demographical information of a participant and a table to record the experimental data of a participant.

Design of the Study

There are four elements of experimental design considered in this study. They are: (i) balancing the number of participants for each system; (ii) balancing the gender distribution of participants between the two systems; (iii) maintaining the time of the experiment; and (iv) counterbalancing the order of items to be searched.

Two display systems are compared in this experiment, namely, nongraphical and graphical displays. Due to the setup and the availability of the Polymer Laboratory (which is currently active/in use), the experiment was separated into two parts – the first part was by using the current setup of the laboratory for the nongraphical system evaluation, and the second part was by using the modified setup of the laboratory for the graphical system evaluation. Thus, the first sixteen participants (participant number 1-16) were assigned to the current system, while the remaining participants (participant number 17-32) were assigned to the new system.

To avoid gender bias in the evaluation, the number of male and female participants for this experiment was equal, that is, eight males and eight females for each group (NonGraphical and Graphical).

The experiment was only run between 10:00 AM to 5:00 PM. This was due to the consideration of the human circadian rhythm, in which, human is expected to have a similar level of alertness, coordination, and reaction time during that period.

The 150 items in the laboratory were categorized into four categories – machine, machinery accessories, safety equipment, and lab apparatus. Out of the 150 items, sixteen items were chosen to be searched during the experiment – four items for each category. In order to avoid the effect of sequencing in searching the items, Latin Square counterbalancing method was employed. This is to ensure that the item to be searched was alternated by its category (i.e. if the first item to be searched is a machine, the second item will be from another category, so on and so forth). In addition, because there were four items to be searched for each category, the pattern of the sequence of the item to be searched was designed differently from one cycle to another. In explanation, the category of the item to be searched were labelled as A, B, C, and D for machine, machinery accessories, safety equipment, and lab apparatus respectively; and Table 1 lists the arrangement of the item to be searched by employing the Latin Square Method.

Table 1: Counterbalancing of the arrangement of the item to be searched

	1st item to be searched	2nd item to be searched	3rd item to be searched	4thitem to be searched
1st cycle	A	B	D	C
2nd cycle	B	C	A	D
3rd cycle	C	D	B	A
4th cycle	D	A	C	B

Procedure

Informed Consent Form: Participants were asked to read the informed consent form for a better understanding of the study and to provide their consent to participate in the study. Then, participants were given a chance to ask any question regarding the experiment without jeopardizing the objective of the experiment. After that, the experimenter briefly explained the procedure, potential risks (if any), voluntary and confidentiality statement of the study, and the benefit of the study in general. Once a participant agreed to participate in the study, he or she was asked to sign the form that provides his or her consent to participate in the study.

Demographic Data: Participant's demographic data were collected and recorded in the first part of the participant data form.

Experimental Session: In the experiment, there are sixteen items that need to be searched by a participant (one by one). For each item, a card containing the name of the item to be searched was shown to a participant (experimenter was also verbally reading the name of the item), and he or she was asked to find that item. The stopwatch was started right after the name of the item was pronounced and was stopped right after the item was pointed by the participant. The completion time of searching the item was recorded in the participant data form. In addition, the errors made in searching the item (if any) was also recorded in the participant data form. The process was repeated from one item to another by following the designed Latin Square Counterbalancing.

Thanking Session: Participants were thanked and debriefed for their participation in the study.

Variables and Hypotheses

Dependent Variable 1: Completion Time (in seconds). The time taken to search an item (right away after the name of the item was pronounced by experimenter until the item was pointed by the participant) was recorded.

Hypothesis 1: The graphical displays group will complete the searching task better (faster completion time) compared to the nongraphical displays group. This is because, the symbol or graphical (graphical displays) can be recognized faster and more precisely than text alone ((Smiciklas, 2012); (Bridger, 2008)).

Dependent Variable 2: Errors Made. If a participant pointed on/at the wrong item, the mistake/s will be recorded (e.g. one for one mistake, two for two mistakes, so on and so forth.

Hypothesis 2: The graphical displays group will perform better (lower number of errors made) compared to the nongraphical displays group. This is because, the symbols or graphics (graphical displays) can be recognized faster and more precisely than text alone ((Smiciklas, 2012); (Bridger, 2008)).

RESULTS

The Effect of Graphical Displays on Completion Time

The raw data obtained from the experiment was transferred into the SPSS software (version 25). The data was then analyzed to compute the mean of the completion time for both groups (graphical and non-graphical displays). From the output, the descriptive statistics graph – average mean scores – was plotted with the mean error bar as illustrated in Figure 3. In order to analyze this finding, the Independent Sample T-Test was applied. This model was utilized because there are only two variables being compared, and the participant of the Graphical and NonGraphical group were independent to each other – i.e. different participant (Morgan, Leech, Gloeckner, & Barrett, 2013)

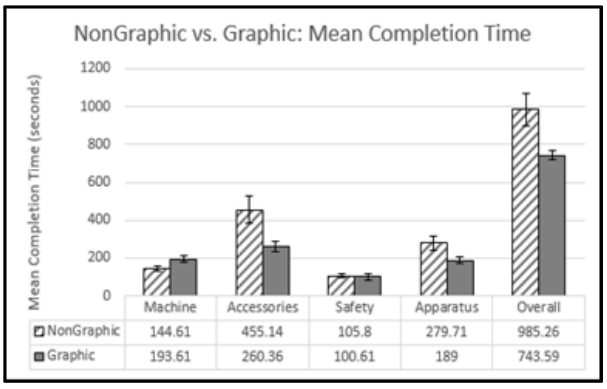

Figure 3: Comparison of the mean of completion time between Graphical and NonGraphical group

Overall, the Graphical group performed better (M = 743.59 seconds) rather than the NonGraphical group (M = 985.26 seconds). The output of the model given that there was a significant difference in the performance for Graphical (M = 743.59, SD = 103.57) and NonGraphical (M = 985.26, SD = 345.50) conditions; t (16) =2.680, p =0.015. This result suggests that different type of displays of labeling system does have an effect on completion time of the searching tasks. Specifically, the result suggests that when graphical displays are applied to the labeling system, the completion time for searching task decreases significantly.

Comparing the scores of the completion time by category – machine, machinery accessories, safety equipment and lab apparatus – completion time of Graphical group is generally less than the NonGraphical group except for the machine category.

Machine Category: On average, Graphical group performed worst (M = 193.61 s) compared to the NonGraphical group (M = 144.61 s). The output of the model given that there was a significant difference in the performance for Graphical group (M = 193.61, SD = 67.54) and Nongraphical group (M = 144.61, SD = 65.76) conditions; t (16) = 0.887, p = 0.046. This result suggests that the different type of displays has an effect on completion time for searching tasks for this category of items. However, the finding for this category was contrary to the hypothesis, meaning, the completion time increases with the use of Graphical displays.

Machinery Accessories: On average, Graphical group performed better (M = 260.36 s) compared to the NonGraphical group (M = 455.14 s). The output of the model given that there was a significant difference in the performance for Graphical group (M = 260.36, SD = 103.46) and NonGraphical group (M = 455.14, SD = 283.25) conditions; t (16) = 0.000, p = 0.018. suggests that the different type of displays has an effect on completion time for searching tasks for this category of items. The finding for this category agrees with the hypothesis, in which, when graphical displays was applied, the completion time decreases.

Safety Equipment: On average, Graphical group performed better (M = 100.61 s) compared to the NonGraphical group (M = 105.80 s). However, the output of the model given that there was no significant difference in the performance for Graphical group (M = 100.62, SD = 60.18) and NonGraphical group (M = 105.80, SD = 50.82) conditions; t (16) = 0.749, p = 0.794 suggests that the different type of displays does not have an effect on completion time for searching tasks for this category of items.

Lab Apparatus: On average, Graphical group performed better (M = 189.00 s) compared to the NonGraphical group (M = 279.71 s). The output of the model given that there was a significant difference in the performance for Graphical group (M = 189.00, SD = 72.01) and NonGraphical group (M = 279.71, SD = 154.47) conditions; t (16) = 0.056, p = 0.042 suggests that the different type of displays has an effect on completion time for searching tasks for this category of items. The finding for this category agrees with the hypothesis, in which, when graphical displays was applied, the completion time decreases.

The Effect of Graphical Displays on Errors Made

The raw data obtained from the experiment was transferred into the SPSS software (version 25). The data was then analyzed in order to compute the mean of the errors made for both groups. From the output, the descriptive statistics graph – average mean scores – were plotted with the mean error bar as illustrated in Figure 4. In order to analyze this finding, the Independent Sample T-Test was applied. This model was utilized because there are only two variables being compared, and the participants of the Graphical and NonGraphical group were independent to each other – i.e. different participant (Morgan, Leech, Gloeckner, & Barrett, 2013).

Overall, the Graphical group performed better (M = 0.19) compared to the NonGraphical group (M = 1.13). The output of the model given that there was a significant difference in the performance for Graphical group (M = 0.19, SD = 0.544) and NonGraphical group (M = 1.13, SD = 1.360) conditions; t (16) =2.560, p =0.019 suggests that different type of displays of labeling system has an effect on errors made during the searching tasks. Specifically, the results suggest that when graphical displays are applied to the labeling system, the errors made during the searching task decreases.

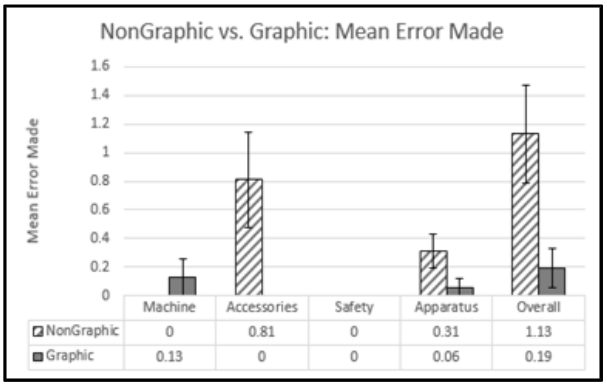

Figure 4: Comparison of the mean of error made between Graphical and NonGraphical group

Comparing the errors made by category – machine, machinery accessories, safety equipment and lab apparatus – the results reveal that: only the Machinery Accessories category has a significant difference; the Lab Apparatus category has a partially significant difference; the Machine category showed no significant difference; while for the Safety Equipment category the statistical analysis could not be run due to the zero-error made by both groups.

Machine Category: On average, the Graphical group performed worse (M = 0.13) compared to the NonGraphical group (M = 0.00). However, the output of the model given that there was no significant difference in the performance for Graphical group (M = 0.13, SD = 0.50) and Nongraphical group (M = 0.00, SD = 0.00) conditions; t (16) = -1, p = 0.333 suggests that

the different type of displays does not have any effect on errors made during searching tasks for this category of items.

Machinery Accessories: On average, the Graphical group performed better (M = 0.00) when compared to the NonGraphical group (M = 0.81). The output of the model given that there was a significant difference in the performance for Graphical group (M = 0.00, SD = 0.00) and NonGraphical group (M = 0.81, SD = 1.328) conditions; t (16) = 2.448, p = 0.027, suggests that the different type of displays has an effect on the errors made during searching tasks for this category of items. The findings for this category agrees with the hypothesis that the error made decreases when Graphical displays are used.

Safety Equipment: As mentioned above, the mean for both groups were zero (i.e. there was not a single error made by both group during the search tasks), thus, the statistical analysis could not be run. This result suggests that the different type of displays does not have any effect on errors made during searching tasks for this category of items.

Lab Apparatus: On average, the Graphical group performed better (M = 0.06) compared to the NonGraphical group (M = 0.31). The output of the model given that there was a partially significant difference in the performance for the Graphical group (M = 0.06, SD = 0.25) and the NonGraphical group (M = 0.31, SD = 0.479) conditions; t (16) = 1.852, p = 0.077 suggests that the different type of displays has an effect on the errors made during searching tasks for this category of items. The finding for this category agrees with the hypothesis that the errors made decrease with the application of Graphical displays.

DISCUSSION

The Effect of Graphical Displays on Completion Time

Table 2 summarizes the finding of the effect of graphical displays on completion time in searching the laboratory items. As shown in Table 2, overall, the Graphical group performed significantly better compared to the NonGraphical group. This finding is in parallel with Smiciklas (2012) who found that symbols or graphical representations can be recognized faster and more precisely than text alone (i.e. nongraphical displays), thus, minimizing the completion time in searching the laboratory items.

Table 2: Summary of the findings (Completion Time)

Item Category	Mean Score (Which one is better?)	Significantly Different?
Overall	Graphical	Yes
Machine	NonGraphical	Yes
M. Accessories	Graphical	Yes
Safety Equipment	Graphical	No
Lab Apparatus	Graphical	Yes

In terms of the item categories, the Graphical group performed significantly better compared to the NonGraphical group in the Machinery Accessories and Lab Apparatus categories. As mentioned above, these findings align with Smiciklas (2012) with the same explanation. In contrast, the Graphical group performed significantly worse compared to the NonGraphical group in the Machine category. One explanation may be that whenever the items to be searched are bulky (i.e. large item) and the location of the item can be seen from a distance (e.g. not inside a drawer), the participant tends to search the item solely without any dependence on the graphical displays. Thus, the effect of the graphical displays may not be reflecting in the completion time in searching tasks. However, this explanation can only be validated with future research. For the Safety Equipment category, the difference between the two groups was not found to be significant. One can surmise that because all the safety equipment was placed in the same cabinet, it probably promotes memory bias among the participants. In addition, another possibility might be that the safety equipment items can be easily recognized and differentiated (e.g. apron, face shield, and latex glove). Again, these possibilities can only be verified or validated with future research.

The Effect of Graphical Displays on Errors Made

Table 3 summarizes the finding of the effect of graphical displays on errors made during the searching tasks. As shown in Table 3, overall, the Graphical group performed significantly better compared to the NonGraphical group. As mentioned before, this finding is in parallel with Smiciklas (2012) minimizing the error made by the participants during the searching tasks.

Table 3: Summary of the findings (Error Made)

Item Category	Mean Score (Which one is better?)	Significantly Different?
Overall	Graphical	Yes
Machine	NonGraphical	No
M. Accessories	Graphical	Yes
Safety Equipment	n/a	n/a
Lab Apparatus	Graphical	Partially

In terms of the item categories, the Graphical group performed significantly better compared to the NonGraphical group in the Machinery Accessories and Lab Apparatus (partially) categories. These findings align with Smiciklas (2012). For the Machine category, there is no significant difference between the groups, however, the NonGraphical group has a better mean value in comparison to the Graphical group. One possibility might be that whenever the items to be searched are bulky (i.e. large item) and the location of the item can be seen from a distance (e.g. not inside a drawer), participants tend to search the item solely without any dependence on the graphical displays. Thus, the effect of the graphical displays may not be observed on errors made during the searching tasks. However, this explanation can only be validated with future research. For the Safety Equipment, both groups did not make any errors during the searching tasks. Thus, with a mean of zero, the statistical analysis cannot be done. One explanation could be that because all the safety equipment was placed in the same cabinet, it probably promotes memory bias among the participants. In addition, another assumption may be that the safety equipment items can easily be recognized and differentiated (e.g. apron, face shield, and latex glove). Again, these possibilities may only be validated with future research.

CONCLUSION

As a conclusion, the current study found that the use of graphical displays in labeling systems for searching tasks reduces the completion time and the errors made during the searching tasks, when compared to non-graphical displays. For completion time, overall, there was a significant difference in the performance between the Graphical group (M = 743.59, SD = 103.57) and the NonGraphical group (M = 985.26, SD = 345.50) conditions; t (16) =2.680, p =0.015. For errors made, overall, there was a significant difference in the performance between the Graphical group (M = 0.19, SD = 0.544) and the NonGraphical group (M = 1.13, SD = 1.360) conditions; t (16) =2.560, p =0.019.

Contribution: The results from this study provide additional knowledge in the application of graphical displays on human performance in general. Specifically, the findings recommend graphical displays as a better and suitable display type of labeling system for laboratory searching tasks. The findings of the study showed that the adoption of graphical displays in labeling the laboratory items for search could minimize the completion time and reduce the errors made in finding items in a laboratory. These optimizations in managing a laboratory can be of added value for both, a particular system e.g. labeling system as well as other similar systems. Thus, these findings can support further research and field application.

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REFERENCES

Bridger, R. (2008). *Introduction to Ergonomics, 3rd Edition,*. Boca Raton: CRC Press Book.

Heer, J., Bostock, M., & Ogievetsky, V. (2010). A tour through the visualization zoo. *Communication of the ACM*, 59-67.

Kanamori, S., Sow, S., Castro, M., Matsuno, R., Tsuru, A., & Jimba, M. (2017). Implementation of 5s Management Method for Lean Healthcare at a Health Center in Senegal: A quantitative Study of Staff Perception. *Global Health Action*.

Khamis, N., Ab Rahman, M., Jamaludin, K., Ismail, A., Ghani, J., & Zulkifli, R. (2009). Development of 5s Practice Checklist for Manufacturing Industry. *World Congress on Engineering*. London: World Congress on Engineering.

Mahzan, N., & Hassan, N. (2015). Internal Audit of Quality in 5s Environment: Perception on Critical Factors, Effectiveness, and Impact on Organizational Performance. *International Journal of Academic Research in Accounting, Finance, and Management Sciences, Vol. 5*, 92-102.

Milosevic, M., Macuzic, I., Todorovic, P., Djapan, M., Giagloglou, E., & Vuckovic, D. (2013). Implementation of the 5s System as a Factor for Improving the Quality Management. *7th International Quality Conference* (pp. 585-590). Serbia: University of Kragujevac.

Mizuho, K., Koji, T., & Itiro, S. (2011). DrawerFinder: Finding Item in Drawer using Images and Visual Markers. *Japan Science and Technology Agency (JST)*, 363-366.

Morgan, G., Leech, N., Gloeckner, G., & Barrett, K. (2013). *IBM SPSS for Introductory Statistics: Use and Interpretation*. New York: Talor & Francis.

Norman, K. (1991). *The Psychology of Menu Selection: Designing Cognitive Controls at the Human/computer Interface*. Michigan: Ablex.

Sanders, M., & McCormick, E. (1993). *Human Factors in Engineering and Design*. New York: Mc-Graw-Hill.

Singh, A., & Ahuja, I. (2014). Evaluating the Impact of 5s Methodology on Manufacturing Performance. *International Journal of Business Continuity and Risk Management, Vol. 5*, 272-305.

Smiciklas, M. (2012). *The power of infographics.* Indiana: QUE Publishing.

Tayyari, F., & Smith, J. (1997). *Ocuupational Ergonomics: Principles and Application.* London: Chapman and Hall.

Tsuchiya, K. (6, 1999). *My Qalgilia.* Retrieved from MY Qalgilia: http://www.myqalqilia.com/5SNOTES.pdf