



INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN PROGRESSIVE EDUCATION & DEVELOPMENT



www.hrmars.com

ISSN: 2226-6348

Five Spectacular of the Six Sigma DMAIC Model to Improve the Quality of Teacher Teaching in Schools: Revolution or Fantasy?

Siti Hannah Sabtu, Mohd Effendi @ Ewan Mohd Matore, Siti Mistima Maat

To Link this Article: <http://dx.doi.org/10.6007/IJARPED/v12-i2/16905>

DOI:10.6007/IJARPED/v12-i2/16905

Received: 09 March 2023, **Revised:** 14 April 2023, **Accepted:** 01 May 2023

Published Online: 19 May 2023

In-Text Citation: (Sabtu et al., 2023)

To Cite this Article: Sabtu, S. H., Matore, M. E. @ E. M., & Maat, S. M. (2023). Five Spectacular of the Six Sigma DMAIC Model to Improve the Quality of Teacher Teaching in Schools: Revolution or Fantasy? *International Journal of Academic Research in Progressive Education and Development*, 12(2), 615–626.

Copyright: © 2023 The Author(s)

Published by Human Resource Management Academic Research Society (www.hrmars.com)

This article is published under the Creative Commons Attribution (CC BY 4.0) license. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this license may be seen at: <http://creativecommons.org/licences/by/4.0/legalcode>

Vol. 12(2) 2023, Pg. 615 - 626

<http://hrmars.com/index.php/pages/detail/IJARPED>

JOURNAL HOMEPAGE

Full Terms & Conditions of access and use can be found at
<http://hrmars.com/index.php/pages/detail/publication-ethics>



INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN PROGRESSIVE EDUCATION & DEVELOPMENT



www.hrmars.com

ISSN: 2226-6348

Five Spectacular of the Six Sigma DMAIC Model to Improve the Quality of Teacher Teaching in Schools: Revolution or Fantasy?

¹Siti Hannah Sabtu, ²Mohd Effendi @ Ewan Mohd Matore, ³Siti
Mistima Maat

¹Faculty of Education, The National University of Malaysia (UKM), 43600 Bangi, Selangor, Malaysia, ^{2,3}Research Centre of Education Leadership and Policy, Faculty of Education, The National University of Malaysia (UKM), 43600 Bangi, Selangor, Malaysia
Corresponding Author's Email: effendi@ukm.edu.my

Abstract

The effectiveness of education depends on the competence and teaching quality of a teacher. Existing practices in teaching must be revolutionized and other solutions must be introduced to ensure that quality continues to increase instead of remaining stagnant. This conceptual paper aims to explain the Six Sigma approach in education through the Six Sigma DMAIC model to improve the quality of teacher teaching. The Six Sigma DMAIC model cycle consists of five phases: Define, Measure, Analyze, Improve, and Control. The development of the Six Sigma DMAIC model's corpus of knowledge helps teachers improve the quality of teaching in the classroom and meet the needs of students. The new concept of the Six Sigma DMAIC model implementation in education also works through an in-depth diagnosis of issues related to teaching problems, which simultaneously facilitates the planning of effective interventions. Besides, the concept of sigma in the technical field has the potential to be developed in the field of education. The current findings provide a dimension of innovation in the education sector in improving the quality of teacher teaching using the Six Sigma DMAIC model, which will have a significant impact on the academic success of students. Therefore, education policymakers should be more aggressive in strengthening the quality of education towards the success of quality and dynamic human capital through the latest practices with the sigma concept.

Keywords: Quality, Education, Teacher Teaching, Six Sigma, DMAIC Model

Introduction

Education is one of the important aspects that must be strengthened since the progress of a country depends on its underlying education system (Kakingo & Lekule, 2021; OECD, 2015). The quality of education refers to the extent to which the education system is able to achieve the generally accepted educational goals that focus on the knowledge and skills of its implementers, namely teachers, to realize the nation's educational goals. The quality of teacher teaching has a great influence on students; the higher the quality of teaching

delivered to students, the more motivated students are to learn (Ngang et al., 2015; Sogunro, 2017). Teachers are also responsible for determining the effectiveness of students' learning process through teaching because the quality of the outcome of student learning is determined through the teaching methods delivered by the teachers (Graham et al., 2020; Rizki et al., 2021). Essentially, the focus on improving the quality of the education system should not be taken for granted in order to produce quality human capital. In fact, quality human capital can only be established through quality education (Graham et al., 2020; Rizki et al., 2021). Therefore, the quality of teacher teaching plays an important role in determining the satisfaction of students, who are customers in educational institutions, because they have requirements that must be met by the teachers (Amirian et al., 2022). In this regard, teachers also need to constantly improve their competence and quality to ensure the effectiveness of quality in their teaching (Blomeke & Olsen, 2019; Olawoyin & Isuku, 2019).

Correspondingly, the Six Sigma approach is seen as a new alternative that can be used to help educational institutions improve the quality of teacher teaching. According to Cano et al (2016); Cudney et al (2014), Six Sigma is an approach that brings additional benefits in helping educational institutions adopt the best practices for service delivery through quality processes that ensure its success (Cano et al., 2016; Cudney et al., 2014). Six Sigma is not only an approach used to measure quality levels but also to identify areas of weakness in an organization in order to improve and meet customer needs (Bloom, 2018; Pyzdek & Keller, 2018). Therefore, Six Sigma has undergone a revolution and has been successfully adopted in most fields of education (Kremcheeva & Kremcheev, 2019; Pal & Ghosh, 2022).

As reported in previous studies, among the areas in education that can be improved by applying the Six Sigma approach include curriculum, infrastructure, student learning performance, academic achievement, learning community, as well as teaching and learning (Abdulla & Kavilal, 2022; Arafeh et al., 2021; LeMahieu et al., 2017; Maclel-Monteon et al., 2020). Although it is rather difficult to apply Six Sigma in education, the literature has proven that this concept indeed has high potential to be used for improving the quality of teacher teaching (Al Kuwaiti & Subbarayalu, 2015; Sharma et al., 2013; Sunder, 2014; Wang, 2022; Yu & Ueng, 2012). Consequently, such a potential eliminates the stigma that the sigma concept can only be used in a limited context. Now, the concept of sigma is no longer a fantasy because all educators have the opportunity to apply this concept in their careers.

Technical Definitions of Six Sigma

Six Sigma is a business strategy developed by Motorola in the mid-1980s, which aims to identify and eliminate the causes of errors, defects, or failures in business processes by focusing on customer satisfaction (Costa et al., 2021; Pal & Ghosh, 2022). The basic goal of the Six Sigma methodology is a quality improvement system that focuses on improving processes and reducing variations (Mittal et al., 2023). Six Sigma primarily aims to minimize the error rate in work processes, thus reducing customer dissatisfaction (Pande et al., 2014), as customer satisfaction is an important aspect prioritized by product suppliers or service providers.

Pyzdek & Keller (2018) stated that Six Sigma is represented graphically as a bell-shaped curve or normal distribution and a measure that shows the deviation of a characteristic from the

mean, which is six times the standard deviation from the mean, both to the left and to the right. Technically, the Sigma value refers to the efficiency of the process; the higher the Sigma value, the better the process (Breyfogle et al., 2001). In other words, Six Sigma refers to a stage in the process that approaches perfection. Therefore, to reach the level of Six Sigma, the Six Sigma methodology is used to ensure that an organization is able to achieve optimal customer satisfaction (Bloom, 2018; Breyfogle et al., 2001). In the context of teacher teaching quality, the Six Sigma approach is used to monitor and improve this particular aspect. Specifically, Six Sigma is used to detect deficiencies and weaknesses in teaching and learning (T&L) as well as to plan improvement action strategies in order to overcome the identified problems, apart from ensuring that the T&L evaluation of teachers can be made easier and more focused.

The Sigma symbol (σ) refers to the standard deviation originating from Greek, which is often used in Mathematics (Pande et al., 2014; Pyzdek & Keller, 2018). In statistical terms, Six Sigma is defined as a unit of measurement that can reduce problems to 3.4 defects per million opportunities (Fuad, 2019; Pyzdek, 2003). To achieve this level of Six Sigma, the processes in Six Sigma can produce less than 3.4 errors per million opportunities (DPMO) or achieve 99.9966% success (Pande et al., 2014; Pyzdek & Keller, 2018). This means that the processes are so accurate that they can make six standard deviations between the average achievement and the specification limit set by customers (Nitesh, 2020; Yousif, 2019; Zhang et al., 2021). Pyzdek & Keller (2018) also stated that the higher the value of Sigma, the fewer variations will occur in a process and fewer errors will take place. Meanwhile, Bloom (2018) opined that if the value is achieved, then Six Sigma can ensure that the entire productivity process runs optimally. Clearly, Six Sigma is an improvement strategy used by most large companies around the world to increase profits and avoid waste by using poor quality costs in order to improve the effectiveness and efficiency of all operations in meeting customers' needs and wants.

Moreover, when compared to educational institutions, Six Sigma is an element of a business strategy used to improve the efficiency of the education sector (Kremcheeva & Kremcheev, 2019; Pal & Ghosh, 2022). This means that achieving Six Sigma in education requires a high value so that not many mistakes will occur. In the context of teacher teaching quality, the implementation of the Six Sigma approach can help teachers reduce errors in implementing PdP and further improve the quality of teacher teaching. Specifically, errors in PdP can be reduced by identifying the causes of problems encountered when implementing PdP and offering continuous improvement methods to help teachers improve their teaching quality. Thus, the reduction of these errors greatly impacts students in achieving academic excellence.

Six Sigma DMAIC Model

The Six Sigma DMAIC model is a data-driven continuous improvement cycle, which is developed to find weaknesses and inefficiencies, particularly those that cause product or service breakdowns (Costa et al., 2021; Mittal et al., 2023). In other words, it is used to improve existing processes that are at established standards and seek additional improvements. The Six Sigma DMAIC model stands for Define, Measure, Analyze, Improve, and Control. Each phase in the Six Sigma DMAIC model must be carried out according to a set

cycle to ensure the best outcome (Costa et al., 2021; Sandu & Sharma, 2020; Smętkowska & Mrugalska, 2018).

As evidenced in the literature, the Six Sigma DMAIC model has been widely used in educational institutions (Abdulla & Kavilal, 2022; Arafeh et al., 2021; Maclel-Monteon et al., 2020; Sandu & Sharma, 2020; Wang, 2022). Therefore, this model is seen as a systematic approach to evaluate, improve, and enhance the quality of teacher teaching towards achieving perfection to meet customer satisfaction, specifically school students. The Six Sigma DMAIC model cycle begins with defining, then measuring, analyzing, improving, and controlling (Mittal et al., 2023). The conceptualization and operationalization of each phase in the Six Sigma DMAIC model cycle are also identified to evaluate the quality of teacher teaching and help teachers improve the quality of teaching in the classroom.

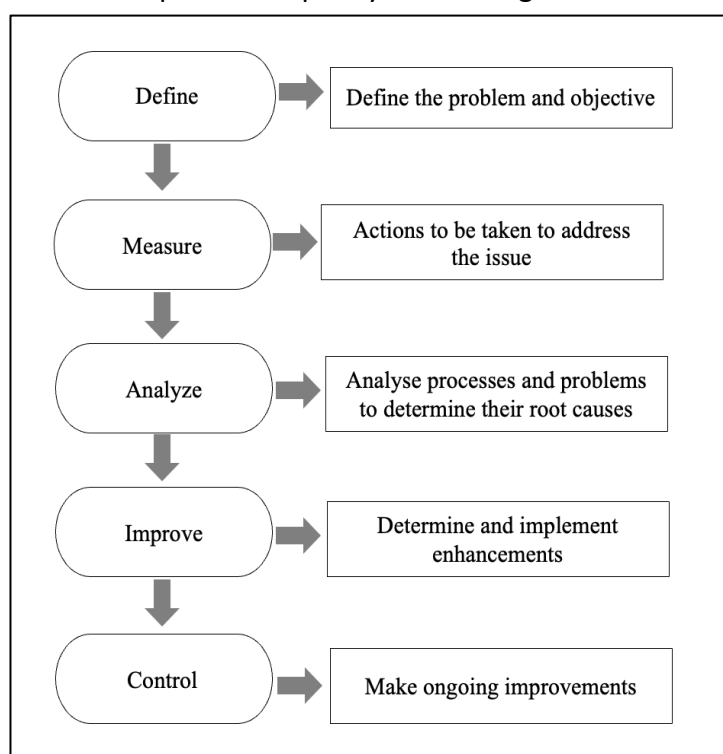


Figure 1: Six Sigma DMAIC Model Cycle

a. Define

The define phase is the first step in the Six Sigma DMAIC model, which focuses on identifying the problem and the goal to be achieved as well as determining what the customers need (Alkoot, 2019; Kremcheeva & Kremcheev, 2019). In other words, this phase focuses on the identification of problems and goals to be solved (Abdulla & Kavilal, 2022; Pande et al., 2014). In the context of this conceptual paper, the problem to be solved involves improving the quality of teacher teaching. Therefore, the focus of this phase is identifying the causes or problems faced by teachers in PdP, identifying the competence and self-efficacy of teachers, and setting the goals to be achieved or improved.

b. Measure

The second phase of the Six Sigma DMAIC model is measure, which involves collecting and analysing data on the problems discovered in the first phase (Abdulla & Kavilal, 2022; Pande et al., 2014). The data in this phase will be used to see the comparison, in terms of

whether there is an increase or decrease in the control phase. In this phase, the collection of information and data must be conducted carefully and accurately to avoid measurement errors. In the context of this study, this phase will detect the causes of T&L that do not reach the set standards and affect the competence and self-efficacy of teachers.

c. Analyze

The third phase of the Six Sigma DMAIC model is analyze, where the collected data will be processed to identify the causes of defects (Pande et al., 2014). The main goal of this phase is to ensure that the improvements to be made are aimed at overcoming the causes of defects, i.e., the cause of the problems (Abdulla & Kavilal, 2022). In this study, the measured data will be analyzed and the main factors affecting the quality of teacher teaching will be identified. The data that has been processed will be used to make plans to improve the quality of teacher teaching. When the important factors affecting the quality of teacher teaching are identified, the same causes will be known (Sandu & Sharma, 2020).

d. Improve

The fourth phase of the Six Sigma DMAIC model focuses on potential problem-solving and improvement issues that have been discovered in the first three phases (Abdulla & Kavilal, 2022; Pande et al., 2014). In this phase, the pedagogic practices and competencies of teachers that do not reach the standards will be improved by proposing some changes to their teaching styles. In addition, improvements for the evaluation of teacher teaching quality will also be implemented from time to time.

e. Control

The final phase of the Six Sigma DMAIC model is control, which refers to the process of ensuring that defects do not recur and that the improvements suggested in the previous phase are continued (Abdulla & Kavilal, 2022; Pande et al., 2014). In other words, the control phase is preventive; any possible problem-related effects discovered in the analysis phase are managed in the control phase. Therefore, in this phase, the implementation of solutions is ensured throughout the improvement process, and the review will continue to ensure the continuous improvement of teacher teaching quality (Sandu & Sharma, 2020). In addition, improvements to the competence and self-efficacy of teachers are also performed in this phase based on the analysis that has been carried out.

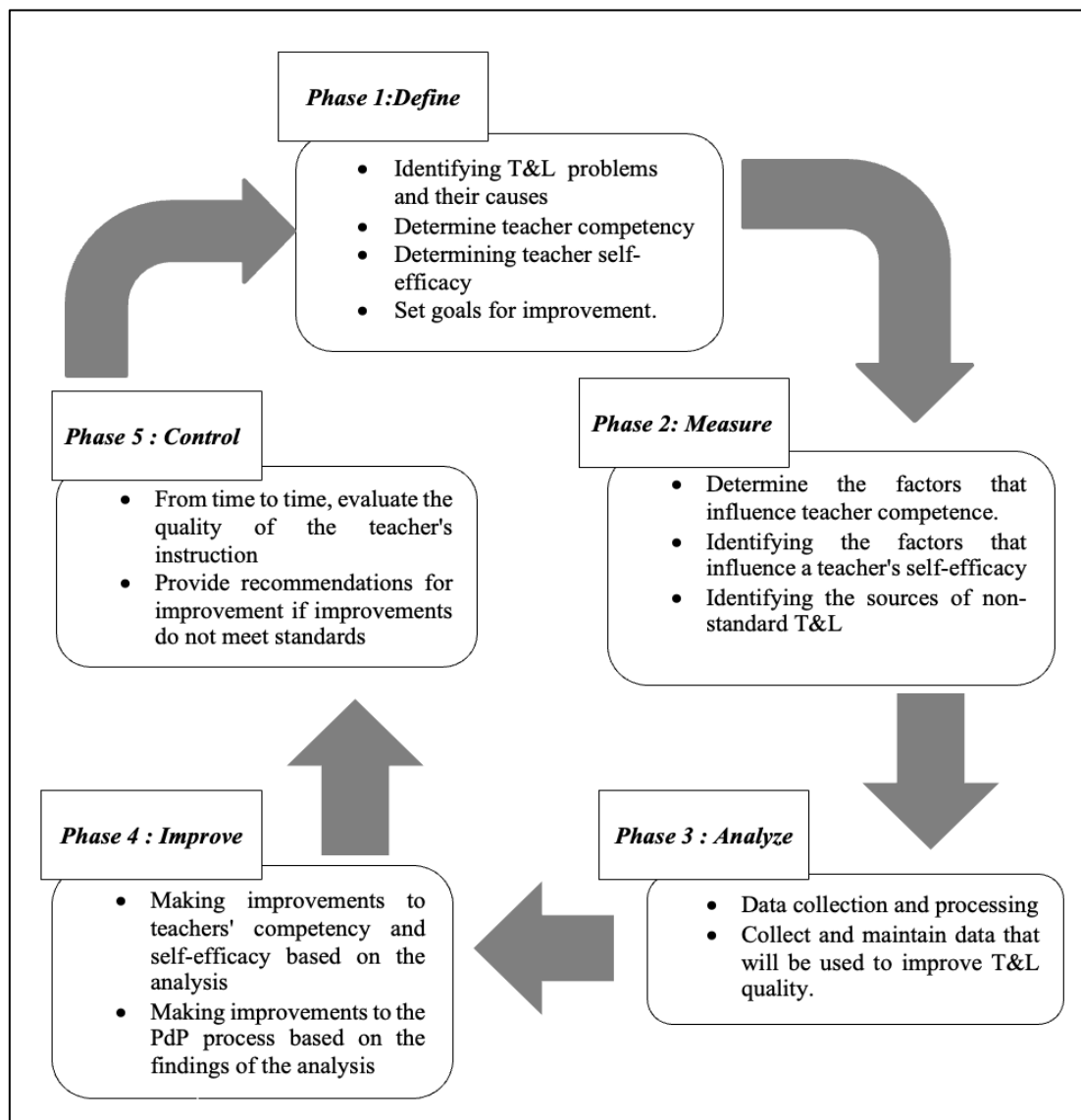


Figure 2: Six Sigma DMAIC Model in Improving Teacher Teaching Quality

Discussion

The Six Sigma DMAIC model is a structured and effective approach to quality improvement in achieving educational excellence (Kremcheeva & Kremcheev, 2019; Shoeibi & Zahmatdoost, 2018). Each phase in the Six Sigma DMAIC model—Define, Measure, Analyze, Improve, and Control—must be carried out according to a set cycle to identify weaknesses or inefficiencies that affect output defects (Bumjaid & Malik, 2019; Cano et al., 2016; Sharma, 2020). Thus, the Six Sigma DMAIC model should be used as a reference and success strategy guide in improving and maintaining the quality of education at the set standards as well as achieving better performance (Rizki et al., 2021; Shoeibi & Zahmatdoost, 2018).

Additionally, the Six Sigma DMAIC model is a practical continuous improvement method to evaluate the quality of teacher teaching and simultaneously help teachers improve their competence and personal skills (Arafah, 2016; Wang, 2022; Yu & Ueng, 2012). The evaluation of existing teacher teaching quality places more emphasis on the rating of teacher teaching rather than detecting weaknesses or improving teaching more effectively (Callahan & Sadeghi, 2015). Furthermore, the evaluator who makes the evaluation also does not know

how to give constructive feedback to teachers or motivate the teachers to improve the quality of teaching (Fresko & Levy-Feldman, 2023). Besides, when compared to the evaluation of teacher teaching quality using the Six Sigma DMAIC model, the main goal is to emphasize the systematic collection and analysis of data in order to correct errors in teaching and learning (PdP) as well as provide suggestions for improvement to overcome the identified problems. Nonetheless, it should be noted that the evaluation of teacher teaching quality is a continuous process and will be impactful when the evaluation is carried out not only by labeling the quality achieved by teachers but also by helping the teachers identify the relevant strategies and development needs in order to achieve the standards set by educational policymakers. However, in real circumstances, most teacher evaluation systems do actually not help improve the competence and quality of teacher teaching. In other words, the result of teacher teaching quality remains the same (Callahan & Sadeghi, 2015; Darling-Hammond et al., 2015; Gerritsen et al., 2016). Moreover, Fresko and Levy-Feldman (2023) found that teacher teaching quality evaluation is not carried out continuously and is only implemented once, and there is also no follow-up action being taken to overcome the problems faced by teachers. Accordingly, the Six Sigma DMAIC model becomes an alternative assessment to help teachers identify problems in T&L more effectively. Although existing teacher teaching quality evaluation practices can help teachers improve their teaching quality, the Six Sigma DMAIC model approach is deemed more comprehensive in terms of its applicability, such as in data collection, analysis, and feedback in different contexts. In addition, the Six Sigma DMAIC model can also be used by teachers as a self-assessment, which entails a formative assessment for identifying problems as well as evaluating and improving existing teaching practices (Akram & Zepeda, 2015). Hence, the Six Sigma DMAIC model can be used as a self-assessment tool and a tool of evaluation among peers to improve the quality of teacher teaching.

Interestingly, the Six Sigma DMAIC model with each phase of DMAIC involves various forms of assessments that can provide information on teacher performance and better decisions on the strategies to improve teacher competence and skills in implementing T&L in the classroom in order to achieve teaching quality standards. Continuous improvement will help teachers improve their competence and expertise over time. In fact, the Six Sigma DMAIC model can also provide an overview of teacher teaching quality more effectively without incurring high costs, and it neither interferes with teachers' time at school nor involves many teachers.

Thus, the new concept of implementing the Six Sigma approach in the education sector through the Six Sigma DMAIC model is a new dimension in improving the quality of teacher teaching. Evidently, this approach focuses on a comprehensive effort to improve the weaknesses that occur during the T&L process in order to produce quality output. Besides, the Six Sigma DMAIC model approach also involves efforts to identify problems faced by teachers and reduces errors in implementing T&L, besides offering continuous improvement methods to help teachers improve their teaching quality. Therefore, in an effort to improve the quality of teacher teaching, it is important to detect the strengths and weaknesses of the teacher teaching quality with the Six Sigma DMAIC model in order to improve and increase educational excellence.

Conclusion

This conceptual paper has explained the Six Sigma approach in education through the Six Sigma DMAIC model to improve the quality of teacher teaching. Students are the main

customers in educational institutions; therefore, their satisfaction with T&L provided by teachers must be enhanced. The effectiveness of teacher teaching quality is determined by the academic improvement of students; the success of a student reflects the success of the process of imparting knowledge to enhance the development of a student and their satisfaction level. Since the Six Sigma DMAIC model has a very high potential to be used to improve a process that is in a critical state, especially when the cause of a problem is not found, the application of the Six Sigma DMAIC model in schools to improve the quality of teacher teaching as an alternative to existing practices is highly recommended. However, all these efforts will be in vain without the commitment of the school management, which is very necessary to ensure effective and quality results. Support from PPD, JPN, and KPM also plays a key role in ensuring the success of its implementation for school improvements. If this is practiced well, then the country's education will surely achieve the desired goal. As the saying goes, "A good education can change anyone, but a good teacher can change everything." Revolutionizing teachers means revolutionizing national education. Now, let us realize the Six Sigma DMAIC model so that it does not remain a fantasy in the measurement of teacher teaching quality.

Contribution

This research adds new views to the theory, measurement, and implementation of the Six Sigma DMAIC model in Malaysian educational institutions for the Malaysian Ministry of Education. This can help policymakers and academics approach the Six Sigma DMAIC model to improve teacher quality of instruction in Malaysia. Stakeholders can undertake in-depth diagnostics of teacher teaching issues in order to develop specific solutions to improve teacher teaching quality. Other than teachers, the Six Sigma DMAIC model can be used to improve self-competence and teaching quality by providing guidelines for planning relevant interventions.

Acknowledgment

This study was funded by the Faculty of Education, Universiti Kebangsaan Malaysia (UKM) under GG-2022-020 (Research Fund of FPEND) and GP-2021-K021854 (Publication Reward Grant). My supervisors, Associate Professor Ts. Dr. Mohd Effendi @ Ewan Mohd Matore and Associate Professor Dr. Siti Mistima Maat, deserve acknowledgement and deep appreciation for their hard contributions to this work. I also want to express my gratitude to the anonymous reviewers for their insightful remarks and recommendations, which enabled them to enhance the article's quality, appearance, and content.

References

- Abdulla, A., & Kavilal. (2022). Analytical Investigation of Higher Education Quality Improvement by Using Six Sigma Approach. *HighTech and Innovation Journal*, 3(2), 196–206. <https://doi.org/10.28991/hij-2022-03-02-07>
- Akram, M., & Zepeda, S. J. (2015). Development and Validation of a Teacher Self-Assessment Instrument. *Journal of Research and Reflections in Education*, 9(2), 134–148.
- Al Kuwaiti, A., & Subbarayalu, A. V. (2015). Appraisal of Students Experience Survey (SES) as a Measure to Manage The Quality of Higher Education in the Kingdom of Saudi Arabia: An Institutional Study Using Six Sigma Model. *Educational Studies*, 41(4), 430–443. <https://doi.org/10.1080/03055698.2015.1043977>
- Amirian, S. M. R., Ghaniabadi, S., Heydarnejad, T., & Abbasi, S. (2022). The Contribution of

- Critical Thinking and Self-Efficacy Beliefs to Teaching Style Preferences in Higher Education. *Journal of Applied Research in Higher Education*, 2(1), 1–17. <https://doi.org/10.1108/JARHE-11-2021-0441>
- Arafeh, M. (2016). Leveraging Six Sigma Tools and Methodology to Improve Student English Language Performance at Elementary School. *American Journal of Operations Research*, 6(4), 261–274. <https://doi.org/10.4236/ajor.2016.64026>
- Arafeh, M., Khader, M., Desouky, T. F., Azzam, N., & Aljundi, A. (2021). Six Sigma Application for Raising Student Academic Achievement. *Management Science Letters*, 11(1), 699–710. <https://doi.org/10.5267/j.msl.2020.10.039>
- Blomeke, S., & Olsen, R. V. (2019). Consistency of Results Regarding Teacher Effects Across Subjects, School Levels, Outcomes and Countries. *Teaching and Teacher Education*, 77, 170–182. <https://doi.org/10.1016/j.tate.2018.09.018>
- Bloom, D. (2018). The Excellent Education System Using Six Sigma To Transform Schools. In *Routledge Taylor & Francis Group*. Routledge Taylor & Francis Group. <http://www.taylorandfrancis.com>
- Bumjaid, S. E., & Malik, H. A. M. (2019). The Effect of Implementing of Six Sigma Approach in Improving the Quality of Higher Education Institutions in Bahrain. *International Journal of Engineering and Management Research*, 9(2), 134–140. <https://doi.org/10.31033/ijemr.9.2.17>
- Callahan, K., & Sadeghi, L. (2015). Teacher Perceptions of The Value of Teacher Evaluations: New Jersey's ACHIEVE NJ. *International Journal of Educational Leadership Preparation*, 10(1), 46–59.
- Cano, E. L., Gonzalez-de-Lena, M., Moguerza, J. M., & Redchuk, A. (2016). Six Sigma as a Quality Improvement Tool for Academic Programs. *Proceedings of EDULEARN16 Conference 4th-6th, 1(July)*, 1644–1652. <https://doi.org/10.21125/edulearn.2016.1329>
- Costa, L. B. M., Godinho Filho, M., Fredendall, L. D., & Devós Ganga, G. M. (2021). Lean Six Sigma in The Food Industry: Construct Development and Measurement Validation. *International Journal of Production Economics*, 1(2), 1–27. <https://doi.org/10.1016/j.ijpe.2020.107843>
- Cudney, E. A., Elrod, C. C., & Stanley, S. M. (2014). A Systematic Literature Review of Six Sigma Practices in Education. *International Journal of Six Sigma and Competitive Advantage*, 8(3–4), 163–175. <https://doi.org/10.1504/ijssca.2014.067552>
- Darling-Hammond, L., Amrein-Beardsley, A., Haertel, E., & Rothstein, J. (2015). Evaluating Teacher Evaluation. *Kappanmagazine.Org*, Jun, 8–15. <https://doi.org/10.4324/9780203053874-32>
- Fresko, B., & Levy-Feldman, I. (2023). Principals' Implementation of Teacher Evaluation and Its Relationship to Intended Purpose, Perceived Benefits, Training and Background Variables. *Assessment in Education: Principles, Policy and Practice*, 00(00), 1–15. <https://doi.org/10.1080/0969594X.2023.2166461>
- Fuad, M. A. (2019). Using 6 Sigma to Improve Outcomes of Higher Education. *International Journal of Information and Education Technology*, 9(1), 46–50. <https://doi.org/10.18178/ijiet.2019.9.1.1171>
- Gerritsen, S., Plug, E., & Webbink, D. (2016). Teacher Quality and Student Achievement: Evidence From a Sample of Dutch Twins. *Journal of Applied Econometrics*, 32(3), 643–660. <https://doi.org/10.1002/jae>
- Graham, L. J., White, S. L. J., Cologon, K., & Pianta, R. C. (2020). Do Teachers' Years of Experience Make a Difference in the Quality of Teaching? *Teaching and Teacher*

- Education*, 96. <https://doi.org/10.1016/j.tate.2020.103190>
- Ho, S. L., Xie, M., & Goh, T. N. (2006). Adopting Six Sigma in Higher Education: Some Issues and Challenges. *International Journal of Six Sigma and Competitive Advantage*, 2(4), 335–352. <https://doi.org/10.1504/IJSSCA.2006.011564>
- Kakingo, J., & Lekule, C. (2021). Influence of Total Quality Management on Students' Academic Achievement in Public Secondary schools in Ifakara Town Council. *East African Journal of Education Studies*, 3(1), 158–171. <https://doi.org/10.37284/eajes.3.1.351>
- Kremcheeva, D. A., & Kremcheev, E. A. (2019). Implementation of the Six Sigma Method in the Educational Process. *Journal of Physics: Conference Series*, 1384(1). <https://doi.org/10.1088/1742-6596/1384/1/012022>
- LeMahieu, P. G., Nordstrum, L. E., & Cudney, E. A. (2017). Six Sigma In Education. *Quality Assurance in Education*, 25(1), 91–108. <https://doi.org/10.1108/QAE-12-2016-0082>
- Maciel-Monteon, M., Limon-Romero, J., Gastelum-Acosta, C., Tlapa, Di., Baez-Lopez, Y., & Solano-Lamphar, H. A. (2020). Measuring Critical Success Factors for Six Sigma in Higher Education Institutions: Development and Validation of a Surveying Instrument. *Institute of Electrical and Electronics Engineers Access*, 8(1), 1813–1823. <https://doi.org/10.1109/ACCESS.2019.2962521>
- Mittal, A., Gupta, P., Kumar, V., Al Owad, A., Mahalwat, S., & Singh, S. (2023). The Performance Improvement Analysis Using Six Sigma DMAIC Methodology: A case study on Indian Manufacturing Company. *Heliyon*, 9(3). <https://doi.org/10.1016/j.heliyon.2023.e14625>
- Musid, N. A., Matore, M. E. @ E. M., Hamid, A. H. A., Abdul Musid, N., Matore, M. E. E., & A. Hamid, A. H. (2023). Leading Digital Leadership in Schools: Future Implications towards Nation Based on The Quadruple Helix Model. *International Journal of Academic Research in Business and Social Sciences*, 12(1), 1861–1872.
- Ngang, T. K., Yie, C. S., & Shahid, S. A. M. (2015). Quality Teaching: Relationship To Soft Skills Acquisition. *Procedia-Social and Behavioral Sciences*, 191(2), 1934–1937. <https://doi.org/10.1016/j.sbspro.2015.04.649>
- OECD. (2015). Education Policy Outlook 2015 Making Reform Happens. In *OECD Publishing*. <https://doi.org/http://dx.doi.org/10.1787/9789264225442-en>
- Olawoyin, M. A., & Isuku, E. J. (2019). Students' Academic Achievement as Influenced by Teachers' Quality: Evidence From Southwest, Nigeria. *European Journal of Education Studies*, 6(7), 52–66. <https://doi.org/10.5281/zenodo.3477663>
- Pal, M., & Ghosh, S. (2022). Applied Six Sigma Theory to Reduce the Drop-Out Rate Among the Student: Systematic Review. *Journal of Social Sciences and Management Studies*, 3(234), 104–108. <https://doi.org/10.56556/jssms.v1i3.234>
- Pande, P. S., Neuman, P. R., & Cavanaugh, R. R. (2014). *The Six Sigma Way How to Maximize the Impact of Your Change and Improvement Efforts* (2nd Edition). McGraw Hill Education.
- Pyzdek, T. (2003). *The Six Sigma Handbook. A Complete Guide for Green Belts, Black Belts and Managers at All Levels*. McGraw-Hill.
- Pyzdek, T., & Keller, P. (2018). *The Six Sigma Handbook A Complete Guide for Green Belts, Black Belts and Managers at All Levels* (5th Edition). McGraw Hill Education.
- Sandu, A. S., & Sharma, P. (2020). Implementation of DMAIC Methodology of Six Sigma in Vocational Education and Training for Quality Improvement. *International Journal of Advance Research and Innovation*, 8(4), 297–301. <https://doi.org/10.13140/RG.2.2.19687.68001>
- Sharma, A. A., Sharma, S., & Dande, P. (2013). Implementation Of Six Sigma For Improving

- Quality Of Higher Education In India. *5th International Conference on Education and New Learning Technologies*, 735–744.
- Sharma, N. K. (2020). *Benefits, Obstacles and Future of Six Sigma Approach*. <https://doi.org/10.13140/RG.2.2.21819.44322>
- Shoeibi, M., & Zahmatdoost, E. (2018). The Role of Six Sigma in Improving the Quality of Higher Education Institutions. *The SIJ Transactions on Computer Networks & Communication Engineering*, 6(4), 01–06. <https://doi.org/10.9756/sijcnce/v6i4/03060250201>
- Smętkowska, M., & Mrugalska, B. (2018). Using Six Sigma DMAIC To Improve The Quality Of The Production Process: A Case Study. *Procedia - Social and Behavioral Sciences*, 238(1), 590–596. <https://doi.org/10.1016/j.sbspro.2018.04.039>
- Sogunro, O. A. (2017). Quality Instruction As A Motivating Factor In Higher Education. *International Journal of Higher Education*, 6(4), 173–184. <https://doi.org/10.5430/ijhe.v6n4p173>
- Vijaya Sunder, M. (2014). Quality Excellence in Higher Education System Through Six Sigma: Student Team Engagement Model. *International Journal of Six Sigma and Competitive Advantage*, 8(3–4), 247–256.
- W. Breyfogle, F., M. Cupello, J., & Meadows, B. (2001). *Managing Six Sigma. A Practical Guide to Understanding Assessing and Implementing the Strategy That Yields Bottom-Line Success*. John Wiley & Sons, Inc.
- Wang, Q. (2022). Application of Six Sigma Management-based Teaching Method in Financial Management Course Online Teaching. *International Journal of Emerging Technologies in Learning*, 17(1), 60–73. <https://doi.org/10.3991/ijet.v17i01.28269>
- Shahata, Y. Y. (2019). Identifying The Reality of Applying Six Sigma Strategy From The Perspective of Administrative Leaders in Colleges Of University Of Baghdad. *International Journal of Research in Social Sciences and Humanities*, 9(1), 293–308. <http://www.ijrssh.com>
- Yu, K. T., & Ueng, R. G. (2012). Enhancing Teaching Effectiveness by Using The Six-Sigma DMAIC Model. *Assessment and Evaluation in Higher Education*, 37(8), 949–961. <https://doi.org/10.1080/02602938.2011.592933>
- Zhang, W., Hill, A. V., & Gilbreath, G. H. (2021). *Six Sigma: A Retrospective and Prospective Study Six Sigma* (Issue 804).