



Implementation of the Ishikawa Diagram in Improving Education Quality

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Abstract

In the era of globalization, digitalization and post-pandemic, education has become something very important because it can influence the competitiveness of a nation, therefore every nation needs quality education. One of them is by implementing Total Quality Management (TQM). In TQM, there are several tools that can be used to improve the quality of education, one of which is the Ishikawa diagram. The aim of this research is to determine the obstacles and results of implementing the Ishikawa diagram in the world of education. The method used is Systematic Literature Review (SLR). From the results of this research, it was found that there were very few obstacles that influenced the application of the Ishikawa diagram and some of the results of its application were an increase in students' interest in learning.

1. Introduction

Nowadays, in the era of globalization, digitalization and post-pandemic, education has become something very important because it can influence a nation's competitiveness. (Schleicher, 2022) in PISA 2022 Insight and interpretations revealing that our schools today are our economies, societies and democracies of the future. From this we can see that school/education has a very serious relationship with the sustainability of a nation's condition. Whether a nation advances or not really depends on that nation's education. This means that if a nation's education can produce quality people, then that nation will progress and be able to win global competition. On the other hand, if a nation's education experiences stagnation or even declines, then that nation will be left behind and lose in competition with other nations (Masruroh & Supratno, 2019).

From the explanation above, we can understand that truly high-quality education is needed to increase the nation's competitiveness and fill the post-pandemic learning loss. Even though the Indonesian Minister of Education claims that there have been good changes during his time at the helm where at the school level he assesses that students can learn in peace because learning activities are assessed holistically by each teacher, school and regional principals can monitor the quality of education through national assessment report cards. education, teachers are increasingly free to be creative and innovate with the presence of their independent curriculum and the development of character and competency is increasingly reflected in university entrance selection in Indonesia which focuses on measuring literacy and reasoning abilities (Nadiem claims that education in Indonesia has experienced major changes in the last 3 years, 2023), but the reality in the field is that there are still many shortcomings, with at least three main points of deficiency. First, problems related to the accessibility of education, namely that it is still limited and

less accommodating of educational institutions towards students. Second, problems related to the quality of learning. This is proven by Indonesia's low ranking in the ranking Program for International Student Assessment (PISA). The last one is the issue of the relevance of education, which will be closely related to outcome from the educational institution (Asep Sunandar, 2024). In fact, apart from these three things, there are still many other problems that exist in the implementation of education in Indonesia, because when these three things are likened to an iceberg, then these three things are only the tip of the iceberg.

To answer and overcome quality problems in education, cooperation from all related parties is needed and continuous improvement is needed so that it can meet consumer expectations. This is in line with the concept in Total Quality Management (TQM) (Subaidi & Khalim, 2018). Furthermore, Witcher (1990) in Syafi'i & Fitriyah, (2020) explains that what is meant by total is that everyone is involved in it, including customers and service/product providers, then Quality is the fulfillment of customer desires and Management is the commitment of the people who have authority to determine regulations.

One piece of equipment (tools) from Total Quality Management which is suitable to use to analyze this is the Ishikawa diagram or better known as the fishbone diagram. This Ishikawa diagram was developed by Dr. Kaoru Ishikawa from the University of Tokyo in 1943. Initially used by the teacher community to summarize the root cause of a problem where the fish head is the main problem while the fish spines (ribs) are the root of the problem while the small spines (riblets) are the link between the causes (Gopinath & Santhi, 2021). This diagram is considered suitable because it is able to visually display the relationship of several factors and is commonly used in root cause analysis and problem solving processes in the industrial world because it is able to identify the causes of problems, supports critical analysis, visualization and interpretation (Bragal & Souza, 2023; Cruz et al., 2023).

Based on the description above, this research was conducted to find the obstacles and barriers experienced during the application of the Ishikawa diagram and the impact of the application of the Ishikawa diagram. Furthermore, it is hoped that the results of this research can provide input to various related parties in using the Ishikawa diagram more effectively and efficiently thus having an impact on improving the quality of education.

2. Methods

This study was prepared using the concept of a literature review using the Systematic Literature Review (SLR) method. This method is carried out by identifying, reviewing, evaluating, and interpreting all available research. Researchers reviewed articles that were appropriate to the topic of the research question. The review process is carried out systematically and structured in each process by following predetermined stages (Triandini et al., 2019).

Then, researchers conducted an in-depth study of the articles that had been reviewed. The Systematic Literature Review technique is carried out in five stages, namely: (1) formulating research questions, (2) mapping and searching for articles that are in accordance with the research questions asked, (3) carrying out inclusion/classification and exclusion/evaluation by selecting articles that has been collected, (4) presenting and processing the data, (5) interpreting the findings in the article and ending in drawing conclusions (Nurfadilah et al., 2022).

The first step the researcher took in this article was, the researcher used literature study method by collecting material sourced from database on Google Scholar and search for articles as research data carried out using software Publish or Perish (PoP). The keywords used to find articles that function as research data are; implementation, Ishikawa diagram, education and "*implementasi*", diagram Ishikawa, "*Pendidikan*" using the software PoP to search for articles. It was carried out first by setting a term or period starting from 2020-2024. The author limited the number of findings taken from Publish or Perish a maximum of 200 findings for each keyword used. Based on the PRISMA guidelines used in the research, 200 articles were found in the article search and after conducting review, initially we separated between articles and non-articles. We found 100 articles and then we sorted them by title until we found 70 articles that met the criteria. Then implemented review returned to articles that are appropriate to the educational context by reading the abstract, results and discussion, we found 33 articles that have relevance or articles that discuss Ishikawa diagrams in the field of education.

Table 1. Eligibility Criteria

Inclusion	Exclusion
Published between 2022 and 2024	The content is not related to the topic and research questions, namely: What are the factors that influence/inhibit the application of the Ishikawa diagram? How are the results after applying the Ishikawa in the field of education?
Articles are journals, proceedings	
Research using Indonesian or English language	

This research uses contest analysis, an analytical technique that can be used systematically to explain and analyze the contents of various books, newspapers and articles in journals or other valid sources to make final conclusions based on research formulations or objectives (Hsieh & Shannon, 2005). This research also seeks an in-depth understanding related to the research title. The main aim of this research is to find answers to questions or problem formulations as follows: 1) What are the obstacles and barriers experienced in implementing the Ishikawa diagram in the field of education? 2) What is the impact of applying/implementing the Ishikawa diagram in the field of education?

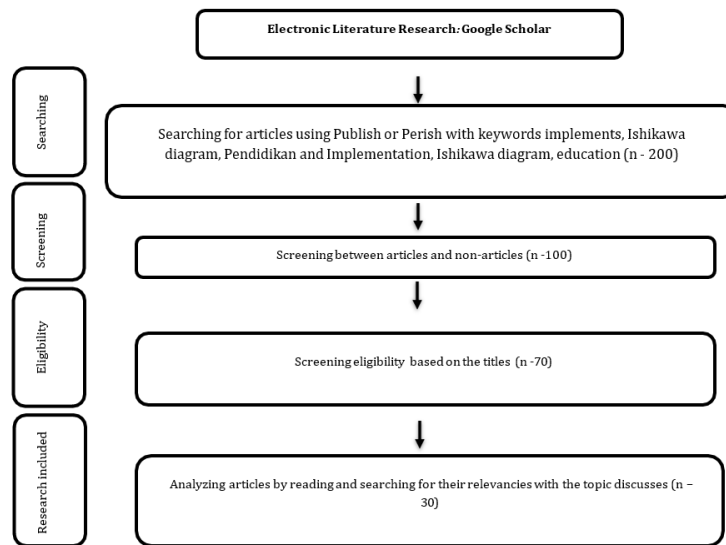


Figure 1. PRISMA (identification of studies via databases)

The selected articles are then analyzed by following the steps, namely (1) Sorting data using Microsoft Excel to facilitate selection and focus on important points relevant to the research topic, (2) Displaying data in the form of tables, narratives and diagrams that have been previously formulated, (3) Drawing conclusions aimed at answering research questions which has been formulated previously.

3. Result and Discussion

Based on the data collection process, there are 30 articles that are the subject of discussion that are suitable for detailed discussion about diagram Ishikawa in the field of education by finding answers to questions or problem formulations as follows: 1) What are the obstacles experienced in the implementation/implementation of the Ishikawa diagram in the world of education? 2) What is the impact of applying/implementing the Ishikawa diagram in the world of education?.

Tabel 2. Results of literature review

No	Researcher(s)	Method	Country	Title
1	(Alves et al., 2022)	Qualitative	Brazil	"Amazonian Corruption Problems in the Education System in the Light of Sustainable Development"
2	(S & Kavilal, 2022)	Qualitative	India	"Analytical Investigation of Higher Education Quality Improvement by Using Six Sigma Approach"
3	(Collins et al., 2021)	RnD	Canada	"Applying Improvement Science to Establish a Resident Sustained Quality Improvement (Qi) Educational Model"
No	Researcher(s)	Method	Country	Title

No	Researcher(s)	Method	Country	Title
4	(Kovtun et al., 2021)	Quantitative	Ukraine	"Contemporary Management of University's Strategic Development: The Case Study on Ukrainian Universities"
5	(Gopinath & Santhi, 2021)	RnD	India	"Development and Evaluation of Fishbone Based Advanced Computational Thinking (Fact) Pedagogy: A Teacher-Student Collaborative Learning Environment in Engineering and Science Education"
6	(Dominguez-Vergara et al., 2022)	Qualitative	Mexico	"Education-To-Go in The Future in Developing Countries?"
7	(Cruz et al., 2023)	Qualitative	Philippines	"Empowering Shs Stem Students Through Fishbone-Based Advanced Computational Thinking Pedagogy"
8	(Elistratova et al., 2022)	Mix method	Russia	"Formation and Development of The Ecosystem of Innovative Education in The Region"
9	(Sallam & Snygg, 2023)	Qualitative	UEA	"Improving Antimicrobial Stewardship Program Using the Lean Six Sigma Methodology: A Descriptive Study from Mediclinic Welcare Hospital in Dubai, The UAE"
10	(Kiat et al., 2021)	Mix method	Singapore	"Implementation of A Quality Improvement Roadmap in The Department of Internal Medicine of An Academic Medical Centre In Singapore"
11	(Sharma et al., 2021)	RnD	India	"Online Machine Drawing Pedagogy—A Knowledge Management Perspective Through Maker Education in The Covid-19 Pandemic Era"
12	(BragaI & Souza, 2023)	Qualitative	Brazil	"Quality Management in The Covid-19 Pandemic: Nursing Action Plan"
13	(Takuyov et al., 2021)	RnD	Ukraine	"Quality of Education and Socio-Economic Growth: The Methods of Ishikawa, Deming and Pareto as Tools for Establishing Cause-Effect Relationships"
14	(Jyż-kuroś et al., 2021)	RnD	Poland	"Stepping (Designing) The Process of Pupils' Writing Chemical Reactions' Equations for Other Pupils"
15	(Sobrinho et al., 2023)	Mix method	Brazil	"Towards Digital Transformation of The Validation and Triage Process of Textbooks in The Brazilian Educational Policy"
16	(Borisova et al., 2021)	Mix method	Russia	"Reserves of Teaching Staff's Productivity Growth Based on Lean Technologies"
17	(Hagutin et al., 2022)	Mix method	Philippines	"Utilization of Statistical Quality Control (SQC) Tools in Evaluating The Self-Learning Modules for Basic Education"
18	(Wahyuni & Darmawan, 2023)	Qualitative	Indonesia	"Analisis Kesalahan Pemahaman Konsep Perkalian Siswa dan Solusinya: Penerapan Metode APKL dan Diagram Fishbone"
19	(Resi et al., 2022)	Qualitative	Indonesia	"Strategi Peningkatan Kualitas Pendidikan di SDN Lancong Kecamatan Sungai Mas Kabupaten Aceh Barat"
20	(Siregar, 2021)	Qualitative	Indonesia	"Pengendalian Kualitas Perguruan Tinggi Swasta Dengan DMAIC (Studi Kasus: Universitas Universal, Batam)"
21	(Puspita et al., 2022)	Quantitative	Indonesia	"The Effect of Stem-Fishbone Diagram Learning on Critical Thinking Ability and Self-Efficacy: A Study on High School Students"
22	(Dwi & Maskuri, 2023)	Qualitative	Indonesia	"Pengembangan Kelembagaan Pendidikan Islam Multikultural Melalui Spirit Entrepreneur Santri (Studi Etnografi di Pondok Pesantren Bahrul Maghfiroh Malang)"
23	(Ramadhani & Khairuna, 2022)	Qualitative	Indonesia	"Pengaruh Model Problem Based Learning Berbantuan Fishbone Materi Biologi Terhadap Kemampuan Berpikir Kreatif Siswa."
24	(Dewy & Dhanil, 2023)	Qualitative	Indonesia	"Penerapan Model Blended Learning pada Materi Flora dan Fauna Indonesia Untuk Meningkatkan Hasil Belajar Hots Peserta Didik."
25	(Indra et al., 2022)	Qualitative	Indonesia	"Media Pembelajaran Berbasis Android Pada Mata Pelajaran Simulasi Dan Komunikasi Digital Kelas X Di SMK Gema Nusantara Bukittinggi."
26	(Budi & Waskito, 2024)	Qualitative	Indonesia	"Pengembangan Manajemen Laboratorium Komputernya Komputernya Guna Peningkatan Kompetensi Siswa Jurusan Desain Komunikasi Visual Smkn 2 Penerbangan Bukit Batu."
27	(Angresia et al., 2022)	Qualitative	Indonesia	"Komik Digital: Media Pembelajaran Pemrograman Dasar di SMK Negeri 1 Ampek Nagari"
28	(Widyahening, 2018)	RnD	Indonesia	"Penggunaan Teknik Pembelajaran Fishbone Diagram Dalam Meningkatkan Keterampilan Membaca Siswa"
29	(Putri et al., 2022)	Qualitative	Indonesia	"Desain Media Pembelajaran Sejarah Berbasis Augmented Reality Di SMA N 1 Koto Xi Tarusan Pesisir Selatan."
30	(Meisya & Yamin, 2022)	Quantitative	Indonesia	"Pengaruh Fishbone Diagram Terhadap Kemampuan Literasi Membaca Peserta Didik Di Sekolah Dasar"

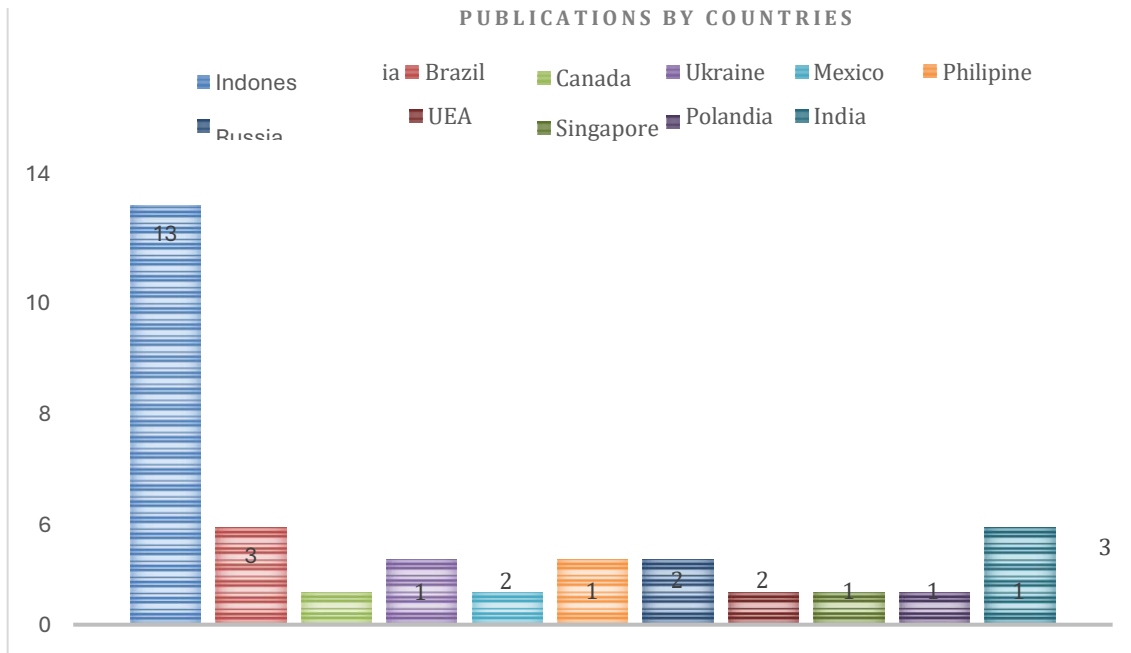


Figure 2. shows a graph that includes the number of publications by each country

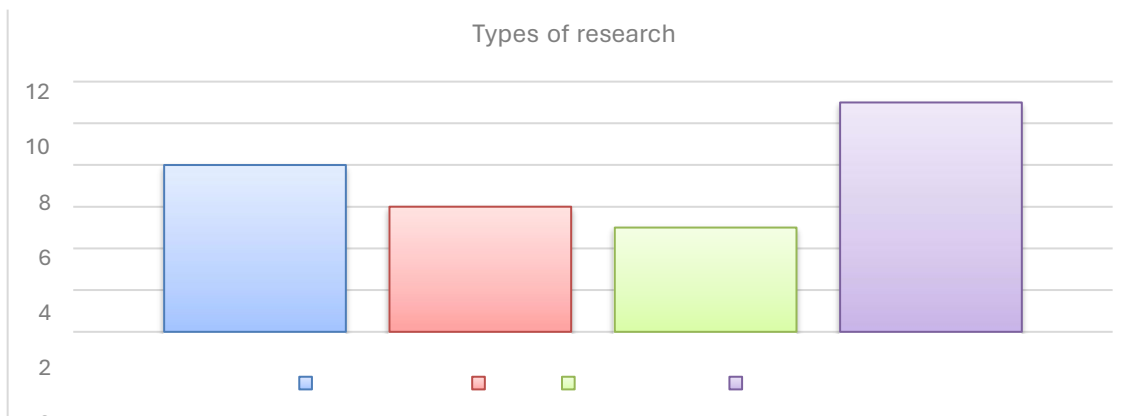


Figure 3. shows a graph of types of research

We will discuss several things that are obstacles to the use of the Ishikawa diagram in the field of education. This is deemed necessary so that in the future it can be utilized more optimally and not face similar obstacles.

Apart from discussing the obstacles found, in this discussion section the results of applying the Ishikawa diagram in the world of education will also be discussed. From the results of previous research, we can understand the results of its application at a level, country and its impact.

3.1 Barriers to Implementing the Ishikawa Diagram

In connection with the application of the Ishikawa diagram, it is very difficult to find obstacles in previous research. This happens because this diagram is only used mostly to analyze a root problem/root cause analysis (RCA) and causal effects (CA). From the many studies that we have collected and analyzed, we have not found any definite obstacles or shortcomings in this Ishikawa diagram. We only found one obstacle related to this diagram because this diagram was used as a learning medium.

In the research of Jyż-kuroś et al., (2021) where they used the Ishikawa diagram to teach students to teach reaction equations, several students experienced difficulty in using the Ishikawa diagram. They prefer using bullet lists rather than using these diagrams. And ultimately students cannot display or share their project experiences with students from other schools. This happens because they do online learning and there are differences in platform facilities of e-learning. After implementing this project, it was discovered that these students had social problems, low work motivation, lack of self-confidence, easily bored and lack of ambition.

3.2 The impact of applying/implementing Ishikawa diagrams in the field of education

In several studies above, we found that the application of the fishbone diagram to improve the quality of education has a significant influence. Among them, research conducted by Meisya & Yamin, (2022) shows the influence of the fishbone diagram on the reading literacy abilities of students in elementary schools with a relatively high effect size. Learning using the fishbone diagram technique which mobilizes thinking and creativity can be used as an innovation to improve reading literacy. This is because the learning process can create interesting learning and encourage students to be more active, creative and innovative. So, students' reading literacy skills can increase and it is hoped that Indonesia's PISA ranking in the following year will also increase.

The Fishbone diagram technique is used to determine cause and effect relationships in a complex idea or event. This technique can help students understand how a main theme has various and interrelated ideas. The Fishbone diagram technique is a very good technique to use in improving students' reading skills (Widyahening, 2018).

We can see that the fishbone diagram can help optimize the goal of improving the quality of education. Such as focusing individuals, teams, or organizations. Focusing on the main problem using this diagram will help us to analyze the problem and help us to focus the problem on priority problems. Makes it easy to illustrate a brief picture of the problem. Determine agreement regarding the cause of a problem. Help to get a solution. And makes it easier for groups to have discussions.

4. Conclusion

Based on the results of the SLR analysis of the use of fishbone diagrams to improve the quality of education, it can be concluded that the use of the fishbone diagram technique has a positive and significant impact/influence on this improvement. This is because the learning process can create interesting learning and encourage students to be more active, creative and innovative. Ishikawa diagram creates an atmosphere that is comfortable, relaxed, active but serious in the teaching and learning process. This atmosphere can make students confidently participate actively in group discussions and discussion activities, make students enthusiastic in reading activities and enthusiastic about participating in the teaching and learning process, confident in sharing ideas with the entire class and also increase mutual respect among them. student. Students also learn to listen to their colleagues' ideas and provide constructive responses to those ideas.

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