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The use of Cause and Effect Diagram (Fishbone) and its impact on Personal Quality Management: Case Study in a classroom during the pandemic of COVID – 19

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Abstract

Personal quality and total quality management (TQM) are key success factors for organizational performance. The combination of individual and team quality management actions leads to motivated people in the workplace and can create high quality processes, relationships and outputs. The Cause and Effect Diagram (Fishbone) is one of the seven most known quality tools and it provides a systematic way of looking at effects and the causes that create or contribute to those effects. It helps an organization to identify, analyze and improve quality issues.

This study examines the use of the Cause and Effect Diagram (Fishbone) quality tool in a classroom during the pandemic of COVID – 19. After the use of the tool by the class participants on personal and team level, students were also asked to assess its impact and provide feedback over the connection of this tool application to personal quality development.

The researchers concluded that on a team basis, the Cause and Effect Diagram helped the team members visually diagram the problems and allowed them to truly diagnose the problem, to separate a problem's content from its history, and facilitated team consensus around its causes. Finally, it is well – known that by team action are cultivated skills such as cooperation, team – thinking, determination, persuasion, creativity, inspiration, fast problem solving, synergy,

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immediate decision making and direct communication.

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1 Introduction

Coronavirus (COVID – 19) accelerated the development of online education in higher education. A set of different tools and platforms got in place and in service for education. Just because the digital platforms can't substitute teaching in class there is needed a shift from traditional and lecture-based activities towards more student-centered activities including group activities, discussions and experimental exercises (Zhu and Liu 2020). This requires conceptual and philosophical rethinking of nature of teaching and learning, roles, and connections among teachers, learners, and teaching materials, in post digital learning communities (Jandrić *et al*., 2018). Full long-term integration of online teaching and learning into university curricula implies further attention to quality (Zhu and Liu 2020).

Although Total Quality Management (TQM) was first designed for the industry, many educators maintained that TQM could also be applied to education especially for bringing educational reforms (Dheeraj, 2004) and reducing waste school resources and increasing productivity (Cunningham, 2007). A systematic and structured Quality management with the aid of relevant tools and techniques must be in action with regard to continuous improvement (Ahmed and Hassan, 2003). So, once the basic problem-solving or quality improvement process is understood, the addition of quality tools can make the process proceed more quickly and systematically.

Multiple tools exist that can identify the source of problems in quality and help focus improvement efforts (Ziegenfuss and McKenna, 1995). A fish-bone diagram is one of the most known quality management tools. It helps to depict the potential causes in order to find the root cause of a particular problem. It also helps to identify, analyze and improve quality issues. The advantage of the Fishbone diagram is that it can break down each identified problem and everybody involved can contribute to the cause of the problem. The fishbone diagram is both a tool and a technique to identify a solution to a problem creatively for the improvement of educational quality (Preuss, 2003).

Personal quality and total quality management are key success factors for organization management (Esaki, 2018). Quality is a very personal obligation and very personal responsibility (Roberts and Sergeskeeter, 1993). Roberts and Sergesketter (1993) offer several illustrations used by executives and students in their book Quality is Personal: A Foundation for Total Quality Management. According to many researchers, personal quality is the basis and it facilitates Total Quality Management at the workplace (Karam, 2014).

A major objective of this paper is to share the importance of using a quality management tools such as the fishbone diagram in classrooms during the pandemic of COVID – 19. Another important aim is to share the effectiveness of this tool based on the survey which was carried out to students of a Master Program during their class of Quality Management. Also the relation of using a quality tool such as fishbone to personal quality management is being analyzed on both individual and teamwork level.

The following section provides a literature overview of personal quality management and the use of fishbone as a quality management tool. After the literature review, we pass to the methodology section where we describe the way the project with the fishbone diagram was applied and the general design of our research. The section prior to the conclusion presents the results of our research and the way the project was perceived by the students.

2 Literature Review

2.1 Personal Quality

The concept of a personal quality, as previously mentioned, was suggested by Roberts and Sergesketter (1993). It has been implemented by systematically keeping personal checklists for quality improvement. The relationship between this checklist and existing personal TQM techniques was studied by Karam (2014).

Quality begins with the individual and people must be promoted internally to perform their job with quality. A focus on personal quality must be emphasized within a company before the beginning of any quality initiative in the workplace. Organizations are made up of employees; each has an important role to play in the improvement of quality inside the organization.

Jambekar (1995) showed that Personal quality improvement offers a risk free experiential framework for individuals to learn not only the basics of quality management but also system thinking. Individuals have continually to undergo education and training to develop further their skill sets and contributions to the organization. Just as expectations are constantly increasing for organizations, the same higher expectations are required of individuals.

Hensel *et al.* (2010) found a relation between personal quality and strategic human resources development. Galvin (1992) noted that one key to implementing a strong quality improvement process in any organization is personal quality.

Choplin *et al*. (1997) conducted a research were they examined the effect of an Inner Quality Management (IQM) training program on 54 employees. Measures of personal and organizational quality in the trained employees were compared to those of a 64-member comparison group that had not received the training. After the completion of the training which lasted seven weeks, the study group reported significant decreases in dimensions of negative affect and stress and significant increases in dimensions of positive affect in relation to the comparison group.

Training on the personal quality level can be of particular value in facilitating major change implementation processes in organizations. In addition, such interventions have the potential to produce long-term improvements in employee health, performance and productivity with a considerable effect to the overall quality at the workplace.

Many studies show a relation between personal quality and several aspects of organization effectiveness (Barrick *et al.,* 2001; Arthur *et al.,* 2003). They recognized criteria of personal quality performance for departmental heads: positive personal characteristics, human relationships, effective communication and exceeding work performance, and they argue that criteria of selection and assignment of departmental heads should be revised so as to include personal quality fields. Baum *et al.* (2001) found that personal quality have a strong influence on the management skills/ competencies. Finally, Vokurka (2001) presented the application of Baldrige criteria for personal quality improvement.

2.2 Fishbone

Total Quality Management tools provide vehicles for data analysis and decision making. Its principles accent the importance of each person in the system to strive for continuous improvement (Abernethy *et al.,* 1992).

The Fishbone diagram, also known as the cause and effect diagram, the root cause analysis, and the Ishikawa diagram, has been named after the Japanese guru, Kaoru Ishikawa. It is a relationship between events or things, a way of observing result and the reason that accounts for those effects. The Fishbone diagram mainly represents a model of suggestive presentation for the correlations between an event and its multiple causes. The diagram focuses on the causes rather than the effect. Because there may be a number of causes for a particular problem, this technique intends to identify the root cause of the problem in a structured and uncomplicated manner. It also helps users to work on each cause prior to finding the root cause (Arunkumar *et al.,* 2017). Root Cause is the deepest underlying cause, or causes, of positive or negative symptoms within

any process that, if dissolved, would result in elimination, or substantial reduction, of the symptom (Preuss, 2003).

The use of Fishbone in Educational sector is reflected in few cases. Jih *et al.* (2011) used it for analysis of e-teaching. Use of 5-why technique for questioning technique was done by Lu (2013). Problems with university and colleges where analyzed by Desai *et al*. (2013). The results of findings of Nasir (2014) who questioned students about fishbone strategy in learning EFL reading have shown the students' positive perceptions of implementing fishbone diagram as a tool organizer in learning EFL reading for comprehension.

Moreover, Martin (2006) found fishbone strategy in teaching reading provided students with reading text enjoyment, with learning how to present in a team work and with a lot of opportunities for learning. Others argued that fishbone diagram and analysis is very innovative and efficient way of resolving key issues of the organizations

Tools for educators are in high demand especially when we are looking for ideas to increase student engagement and teaching (Williams, 2015). The fishbone diagram can be used for educational purposes. The structure provided by the fishbone diagrams helps team members think in a very systematic way (Ilie *et al.,* 2010).

Creating cause and effect chart with team members will help build trust between the members and will allow users to gain new understandings of particular processes in a company. (Valcheva). The Fishbone Diagram can be revised over time as the improvement team deepens their understanding of the systemic causes of a problem. It serves as the bridge between understanding a problem and developing a theory for how to improve the problem.

Gardner (2011) suggests that students learn and internalize information better when teachers use more than one learning modality in an instructional strategy. The Fishbone diagram tool for educators can be used to teach students the leadership skills of strategic thinking and problem-solving (Williams, 2015).

2.3 Teaching during the COVID -19 Pandemic

Restrictions for COVID – 19 disrupted millions of university students' education worldwide and significantly affected the way the Institutions operate. Students and university staff had to make significant adjustments. Beyond using many unfamiliar online media and teaching tools, they also

had to adapt to new methods of engagement, classroom interaction, teaching practices and student-faculty communication.

Online teaching and learning imply a certain pedagogical content knowledge (PCK), mainly related to designing and organizing for better learning experiences and creating distinctive learning environments, with the help of digital technologies (Rapanta *et al.,* 2020). Curriculum and pedagogy need to be updated, and should become models of successful online pedagogies that could be taken into future teachers' practices (Zhu, 2020).

In their research, Rapanta *et al.* (2020) concluded that we should not be talking about 'new' learning, 'what we should be talking about is effective, efficient and enjoyable learning that is facilitated and/or enhanced by the technologies available to the teacher, the learner and the school' (Kirschner, 2015). On the one hand, the design of effective learning environments and embedding online technologies can serve as catalysts for teachers to experiment new things, explore creative alternatives and reflect on their own practices (Goodyear *et al.,* 2009; McKenney *et al.*, 2015).

Online education provides unprecedented access to learning opportunities, as evidenced by its role during the coronavirus pandemic of 2020 (Kizilcec *et al.,* 2020). On the other hand, the fact that teaching students via the Internet might be perceived as having lower motivating potential than more traditional face-to-face teaching (Bali *et al.,* 2018), poses a serious challenge for pandemic e-learning and also for the future of e-learning in higher education.

3 Methodology

Following the literature review which revealed limited available publications on the effectiveness of the fishbone diagram on personal and team level, a decision was made to conduct a research addressing the students of the Master Program following a class on Total Quality Management in order to expand the existing knowledge and produce a base for future research.

The study involved a nonrandom, purposive sample of 34 Master students who were enrolled in a Master Program and were taught about Total Quality Management during the pandemic of COVID – 19. Participants were first introduced to fishbone diagrams and its basic concepts and then they received knowledge over its application with various examples presented in class.

The research was conducted after they had applied their acquired knowledge and had completed their fishbone diagrams on personal basis but also as part of a team work project. Students were

not limited to address specific issues through the fishbone diagrams but to apply the tool on any issue which affected them during the COVID – 19 pandemic. So they were granted the freedom to address any issue which affected them during the corona virus period. Also, as members of a team they decided together the issue for analysis and they were given the opportunity to present their team work at the final lecture of Quality Management. Feedback on the application of the tool was initially provided by the students to the Tutor during the presentation of the teams.

Our research project was separated in two basic parts:

- One part of experimental use of the Fishbone Diagram by the participants on personal and group level where students had the chance to directly express their first impressions of using the model to the tutor during their presentations.
- Another part where the same participants were asked to assess the fishbone quality management tool through a questionnaire after the end of the course period.

It is important to be noted that the second part which was related to the completion of the questionnaire was only asked on a voluntary basis after the delivery of all virtual classes and the grades of participants had already been delivered. Regarding the Questionnaire it consisted of 5 closed - ended items. Each questionnaire item had a seven-point Likert rating scale aiming to measure respondent's assessment general view on the following issues:

- The extent to which participants consider the Cause and Effect Diagram as an important total quality management tool
- The extent to which they consider the use of the model beneficial on a personal basis (after they applied the tool)
- The extent to which they consider the use of the model beneficial on a team -work basis (after they applied the tool)
- The extent to which they consider the fishbone can be used as a personal quality tool.
- The extent to which they consider that organizational quality management is built on personal quality management

In the next section, we proceed to the quantitative results of the questionnaires which were analyzed in this study by using SPSS.

4 Results

Our primary hypotheses were the following:

1. The cause and effect diagram is an important tool of Total Quality Management.
2. The cause and effect diagram is a tool that can be applied effectively on a personal level.
3. The cause and effect diagram is a tool that can be applied effectively at the team level.

Based on the analysis of the results, we observe that in the first question which deals with the extent to which the Cause and Effect Diagram is considered as an important total quality management tool (TQM) 64.7% of the participants believe so to a large and very large extent (Table 1). The results of the second question on whether its implementation was beneficial on an individual level, again we see a high rate of 64.8% of participants claiming this was the case to a large and very large extent (Table 1). The results of the third question on whether its implementation was beneficial on a team level, show a high percentage of 50% saying this was performed to the maximum extent (Table 1). Concerning the 4th question which addresses the extent to which the Fishbone Tool can be used as a personal quality tool, the 53% of the participants estimate that this is done from a large to a very large extent (Table 1). As for the 5th question which concerns the degree to which organizational quality management is built on personal quality management, 61.8% of the participants believe that happens to the maximum degree (Table 1).

Statistics

		Quest1	Quest2	Quest3	Quest4	Quest5
N	Valid	34	34	34	34	34
	Missing	0	0	0	0	0
Mean		5,5588	5,5882	6,2353	5,6471	6,5882
Std. Error of Mean		,16989	,16950	,15257	,17854	,09551
Median		5,5000	6,0000	6,5000	6,0000	7,0000
Mode		5,00	5,00[a]	7,00	5,00	7,00
Std. Deviation		,99060	,98835	,88963	1,04105	,55692
Variance		,981	,977	,791	1,084	,310
Range		3,00	3,00	3,00	3,00	2,00
Minimum		4,00	4,00	4,00	4,00	5,00
Maximum		7,00	7,00	7,00	7,00	7,00

Sum		189,00	190,00	212,00	192,00	224,00
Percentiles	25	5,0000	5,0000	5,7500	5,0000	6,0000
	50	5,5000	6,0000	6,5000	6,0000	7,0000
	75	6,0000	6,0000	7,0000	7,0000	7,0000

a. Multiple modes exist. The smallest value is shown

4: Frequencies Table 1

For the first question, we observe that the minimum value is (4) and the maximum value is (7). There is a large concentration around the average value, ie from 5.56. For the second question, the minimum value is (4) and the maximum value is (7). There is a large concentration around the average value, ie from 5.59. The third question has a minimum value of (4) and the maximum value of (7). There is a large concentration around the mean, ie from 6.24, to the right end of the normal distribution line.

As for the fourth question, we observe that the minimum value is (4) and the maximum value is (7). There is a large concentration around the average value, ie from 5.65. And the last question has a minimum value of (5) and a maximum value of (7). There is a large concentration around the average value, ie from 6.59, to the right end of the normal distribution line.

X^2 statistic is probably the test most often used to test the hypotheses of research carried out by social scientists. This is a non-parametric criterion and does not require any assumptions about the exact form of population distribution. The first table presents the observed and expected frequencies for each of the answers given. The result of x^2 is contained in the last table, where it shows the exact probability that the specific data have occurred (Asymp. Sig.).

For question 1, the value of x^2 is 3.412 and df = 3, level of statistical significance $\alpha = 0.05$ and bilateral control, the critical value is 7.82. For question 2, the value of x^2 is 3.176 and df = 3, level of statistical significance $\alpha = 0.05$ and bilateral control, the critical value is 7.82. For question 3, the value of x^2 is 15.412 and df = 3, level of statistical significance $\alpha = 0.05$ and bilateral control, the critical value is 7.82. For question 4, the value of x^2 is 2.235 and df = 3, level of statistical significance $\alpha = 0.05$ and bilateral control, the critical value is 7.82. For question 5, the value of x^2 is 17.706 and df = 2, level of statistical significance $\alpha = 0.05$ and bilateral control, the critical value is 4.61. Based on these, the conclusion based on questions 3 and 5 in particular is that the results

of the calculations are greater than the critical values, so the findings are sufficient to support (not to prove and generalize) the research hypotheses.

Quest1

	Observed N	Expected N	Residual
4,00	5	8,5	-3,5
5,00	12	8,5	3,5
6,00	10	8,5	1,5
7,00	7	8,5	-1,5
Total	34		

4: X^2 statistics – Question 1 Table 2

Quest2

	Observed N	Expected N	Residual
4,00	5	8,5	-3,5
5,00	11	8,5	2,5
6,00	11	8,5	2,5
7,00	7	8,5	-1,5
Total	34		

4: X^2 statistics – Question 2 Table 3

Quest3

	Observed N	Expected N	Residual
4,00	1	8,5	-7,5
5,00	7	8,5	-1,5
6,00	9	8,5	,5
7,00	17	8,5	8,5
Total	34		

4: X^2 statistics – Question 3 Table 4

Quest4

	Observed N	Expected N	Residual
4,00	5	8,5	-3,5
5,00	11	8,5	2,5
6,00	9	8,5	,5
7,00	9	8,5	,5
Total	34		

4: X^2 statistics – Question 4 Table 5

Quest5

	Observed N	Expected N	Residual
5,00	1	11,3	-10,3
6,00	12	11,3	,7
7,00	21	11,3	9,7
Total	34		

4: X^2 statistics – Question 5 Table 6

Test Statistics

	Quest1	Quest2	Quest3	Quest4	Quest5
Chi-Square	3,412[a]	3,176[a]	15,412[a]	2,235[a]	17,706[b]
df	3	3	3	3	2
Asymp. Sig.	,332	,365	,001	,525	,000

a. 0 cells (0,0%) have expected frequencies less than 5. The minimum expected cell frequency is 8,5.

b. 0 cells (0,0%) have expected frequencies less than 5. The minimum expected cell frequency is 11,3.

4: X^2 statistics Table 7

Moreover, we need to calculate the correlation coefficient of the variables in order to determine if there is an interdependence between them. In case there is not a satisfactory degree of interdependence, there is no reason to proceed with the application / analysis of simple regression.

Here, as is evident (yellowed spots), correlations between (a) question 1 with question 2, (b) question 1 with question 3, (c) question 1 with question 4 can be made because they have satisfactory correlations - for (a) r = 0.706, (b) r = 0.740, (c) r = 0.697.

Correlations

		Quest1	Quest2	Quest3	Quest4	Quest5
Quest1	Pearson Correlation	1	,706**	,740**	,697**	,430**
	Sig. (1-tailed)		,000	,000	,000	,006
	N	34	34	34	34	34
Quest2	Pearson Correlation	,706**	1	,699**	,974**	,343*
	Sig. (1-tailed)	,000		,000	,000	,023
	N	34	34	34	34	34
Quest3	Pearson Correlation	,740**	,699**	1	,714**	,507**
	Sig. (1-tailed)	,000	,000		,000	,001
	N	34	34	34	34	34
Quest4	Pearson Correlation	,697**	,974**	,714**	1	,369*
	Sig. (1-tailed)	,000	,000	,000		,016
	N	34	34	34	34	34
Quest5	Pearson Correlation	,430**	,343*	,507**	,369*	1
	Sig. (1-tailed)	,006	,023	,001	,016	
	N	34	34	34	34	34

**. Correlation is significant at the 0.01 level (1-tailed).

*. Correlation is significant at the 0.05 level (1-tailed).

4: Correlations Table 8

4.1 The cause and effect diagram is a tool that can be applied effectively on a personal level

The following tables refer to the results of a simple regression between the first and second question. According to them, r^2 is 0.50 which means that 50% of the total variation of the application of the cause and effect diagram tool is due to the fact that it is considered an important tool of Total Quality Management at the individual level and its application benefits. As we can observe, the result of the analysis of variance is statistically significant (sig. 0.000 <0.001), so we reject the null hypothesis that there is no linear relationship between the criterion

variable and the predictor variable. This analysis also serves as an additional evaluation criterion for the effectiveness of the predictive model. Also, we can see that the regression coefficient a (constant) has a value of 1.602. From the same table, we find that b has a value of 0.708 and that it is statistically significant (sig. 0.000 <0.001), which means *that the cause and effect diagram tool is applied effectively only if it is considered a valuable tool of Total Quality Management.* Furthermore, b informs us about the type of relationship (positive or negative) between the examined variables, where their positive relationship occurs in this case.

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Quest2[b]	.	Enter

a. Dependent Variable: Quest1

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,706[a]	,499	,483	,71201

a. Predictors: (Constant), Quest2

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16,160	1	16,160	31,876	,000[b]
	Residual	16,223	32	,507		
	Total	32,382	33			

a. Dependent Variable: Quest1

b. Predictors: (Constant), Quest2

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1,602	,711		2,252	,031
	Quest2	,708	,125	,706	5,646	,000

a. Dependent Variable: Quest1

The following tables refer to the results of the simple regression for the first and fourth questions. According to them, r^2 is 0.49 which means that 49% of the total variation of the application of the tool cause and effect diagram is due to the fact that it is considered an important personal quality tool on a personal level and its application benefits. As we see, the result of the analysis of variance is statistically significant (sig. 0.000 <0.001), so we reject the null hypothesis that there is no linear relationship between the criterion variable and the predictor variable. This analysis also serves as an additional evaluation criterion for the effectiveness of the predictive model. Also, we see that the regression coefficient a (constant) has a value of 1.816. From the same table, we find that b has a value of 0.708 and that it is statistically significant (sig. 0.000 <0.001), which means that *the cause and effect diagram tool is applied effectively only if it is considered a valuable personal quality tool.* Furthermore, b informs us about the type of relationship (positive or negative) between the examined variables, where their positive relationship occurs in this case.

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Quest4[b]	.	Enter

a. Dependent Variable: Quest1

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,697[a]	,485	,469	,72175

a. Predictors: (Constant), Quest4

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15,713	1	15,713	30,164	,000[b]
	Residual	16,669	32	,521		
	Total	32,382	33			

a. Dependent Variable: Quest1

b. Predictors: (Constant), Quest4

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1,816	,693		2,621	,013
	Quest4	,663	,121	,697	5,492	,000

a. Dependent Variable: Quest1

4.2 The cause and effect diagram is a tool that can be applied effectively at the team level

The following tables refer to the results of the simple regression for the first and second questions. According to them, r^2 is 0.55 which means that 55% of the total variation of the application of the tool cause and effect diagram is due to the fact that it is considered an important tool of Total Quality Management at team level and its application benefits. As we see here, the result of the analysis of variance is statistically significant (sig. 0.000 <0.001), so we reject the null hypothesis that there is no linear relationship between the criterion variable and the predictor variable. From the table, we can see that the regression coefficient a (constant) has a value of 0.419. From the same table, we find that b has a value of 0.824 and that it is statistically significant (sig. 0.000 <0.001), which means that *the cause and effect diagram tool is applied effectively only if it is considered a valuable tool of Total Quality Management.* Furthermore, b informs us about the type of relationship (positive or negative) between the examined variables, where their positive relationship occurs in this case.

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Quest3[b]	.	Enter

a. Dependent Variable: Quest1

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,740[a]	,548	,534	,67628

a. Predictors: (Constant), Quest3

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17,747	1	17,747	38,805	,000[b]
	Residual	14,635	32	,457		
	Total	32,382	33			

a. Dependent Variable: Quest1

b. Predictors: (Constant), Quest3

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	,419	,833		,503	,619
	Quest3	,824	,132	,740	6,229	,000

a. Dependent Variable: Quest1

4.3 The cause and effect diagram is a tool that is considered personal and thus, can be applied effectively at the individual level

The following tables refer to the results of the simple regression for the second and fourth questions. According to them, r^2 is 0.95 which means that 95% of the total variation of the application of the cause and effect diagram tool is due to the fact that it is considered an important personal tool, and thus can be applied effectively at the individual level. As we can see here, the result of the analysis of variance is statistically significant (sig. 0.000 <0.001), so we reject the null hypothesis that there is no linear relationship between the criterion variable and the predictor variable. From the table, we can see that the regression coefficient a (constant) has a value of -0.084. From the same table, we find that b has a value of 1,026 and that it is statistically significant (sig. 0.000 <0.001), which means that *the cause and effect diagram tool is applied effectively only if it is considered a valuable tool of personal quality*. Furthermore, b informs us about the type of relationship (positive or negative) between the examined variables, where their negative relationship occurs in this case.

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Quest2[b]	.	Enter

a. Dependent Variable: Quest4

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,974[a]	,948	,946	,24118

a. Predictors: (Constant), Quest2

ANOVA[a]

Model	Sum of Squares	df	Mean Square	F	Sig.

1	Regression	33,903	1	33,903	582,872	,000[b]
	Residual	1,861	32	,058		
	Total	35,765	33			

a. Dependent Variable: Quest4

b. Predictors: (Constant), Quest2

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-,084	,241		-,348	,730
	Quest2	1,026	,042	,974	24,143	,000

a. Dependent Variable: Quest4

5 Conclusions

The fishbone Diagram was acknowledged by the students as an important total quality management tool which is beneficial on both personal and team level. By the fishbone diagrams delivered to the tutor that root cause analysis didn't include only incidents or events that involved problematic situations and failures but also events with beneficial outcomes were presented. As it was noted in the Literature, it converts data to information, knowledge, understanding, and wisdom and improves data-based decision making (Preuss, 2003).

The results of this study are in line with the research of Ardianto *et al.* (2020) where fishbone is presented as a mind-mapping tool and an effective way to collect more ideas and thoughts. These findings prove that Fishbone Diagram is used not only for analyzing the root cause of a problem, but also helps participants to find ways to improve the process while it involved an in-depth discussion of the problem, which educates the team. The added value of the tool to the team member experience is proved high through the research results.

The projects students undertook gave them the opportunity to depict their own problems, concerns and issues. This experience was noted as very liberating and this shows how personal quality management supplies a hands-on means for experimental learning. During the

presentations of the fish bone projects students commented on how it helped them capture the main problem and how it leaded them to corrective actions.

The fishbone diagram can provide the problem-solving efforts by *"gathering and organizing the possible causes, reaching a common understanding of the problem, exposing gaps in existing knowledge, ranking the most probable causes, and studying each cause"* (Omachonu *et al.,* 2004).

This research paper shows that quality management practiced through the use of the Fishbone quality management tool provides strengths to the team but also the person itself. Although, none of the participant had used any management tool on personal level before they admitted that the use of fishbone is a tool to be practiced in the workplace but also in their everyday life. It assisted them to take corrective action and re – act upon the results of the fish bones created. Personal quality, according to their experiences, is proved day by day as an essential ingredient to make quality happen in the workplace (organizational quality) but also as a mean to balance personal needs of an individual (personal quality).

Finally, by the way this initiative was designed during COVID– 19 era the findings of many researches are confirmed about how learning activities should be designed and about how teachers are obliged to develop creative initiatives that assist to overcome the limitations of virtual teaching. If teachers invest time in designing learning activities that address learners' cognitive and social needs, better learning outcomes are possible (Rapanta *et al.,* 2020).

Concerning the limitations for this study, the major one was the small sample of students as it was only applied to one Master class. A descriptive survey should be conducted, with interviewees from more sectors to analyze and study in depth the personal quality tools and their importance and implications on the quality at the workplace. In addition, in order to understand deeply the importance and benefit of the use of the personal quality management a very intensive study can be done in one particular industry such as Higher Education.

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