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Synergy Effect of Selected Management Tools – Case Study

Abstract

The aim of this article is to describe the practical application of selected management tools. When these tools are used together, they enable a synergy effect to be attained, which is a more extensive and more accurate analysis of the problem and better prevention than in the case of the application of a single tool. All of the tools used, which are the Ishikawa Diagram, Pareto Diagram, and 5 Why technique, are tools used to diagnose the causes of problems. They can be used separately to examine the problem analysed in this article and jointly to show the synergy effect. This article briefly describes the tools used in the application and indicates the main competencies, i.e. analytical thinking, problem-solving and deep listening, as those that are practiced during classes with students. The paper presents a description of the problem that has arisen, and includes a ready-made case study which can be used during academic classes. It also contains a ready-made sample solution using three classic quality management tools. Moreover, this article concludes with a discussion that summarises the entire article with suggestions and recommendations with regard to didactic, substantive and ethical issues. The suggestions may be helpful when working with students.

The presented case study can be an inspiration for changes to enhance quality, especially for people dealing with comprehensive quality management in various departments of the organisation. Therefore, the study is dedicated not only to academic teachers, students and university management staff, but also to practitioners who use, for example, complaint documentation such as the 8D report or people dealing with communication or quality improvement working with both external and internal clients.

Keywords: management tools, Ishikawa diagram, Pareto principle, 5Why technique, case study, competences, higher education

Introduction

The efficiency achieved by an organisation largely depends on the effectiveness of its manager's operations (Kuc & Żemigała, 2010, p. 4). A good manager, like a good teacher, develops potential, teaches, and guides employees in their development. Just as it is an indispensable part of university education to combine the experience of business practitioners with academic knowledge, business management methods and tools can be combined and applied to a variety of problems not only in business practice. Problems are an inherent part of people's lives, and the methods and tools for resolving them are universal, enabling them to be employed in various aspects of human functioning. The tools that were used in the study are applicable with regard to management and quality management. Meanwhile, these tools have been found to be applicable beyond business problems. Kuczaba-Flisak (2022) and Maciejowska (2020) emphasise that the ability to diagnose problems is one of the key skills that should be acquired in professions involving work with people—it is also a component of the professionalisation pathway for the teaching profession (Maciejowska, 2020, p. 55).

According to *The Future of Jobs Report 2023* (WEF, 2023), analytical thinking is a crucial skill that is highly valued by most employers. This skill encompasses both the capacity for deeper data analysis and the ability to comprehend problems, enabling the separation of facts from thoughts. In the ranking of the ten most important skills for 2025, analytical thinking and innovation were listed at the top (Kozińska, 2022). In a report on empirical research into future competencies and professions, which identifies future skills based on monitoring national sources, complex problem-solving ranks

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first among cognitive competencies, while analytical thinking is ranked fourth (Socha & Wojdyła, 2021). In turn, the respondents toa survey conducted by Łapińska et al. declared that by 2030, analytical skills supported by technology will be crucial. A significant 58% of management representatives acknowledged that this will be an extremely important competence, without which a company would struggle to perform operational tasks and achieve long-term development goals (Łapińska et al., 2022, p. 30).

Fostering or practising any skill—whether strategic or creative thinking—necessitates a commitment from both managers and academic educators, along with ingenuity, expertise, knowledge, and their own creative competencies. The highest level of these competencies—linked to the professional creativity of the teacher—is innovative activity associated with implementing new solutions into academic teaching. These innovations are the result of many years of creative pedagogical efforts by academic teachers (Okraj, 2023, p. 38). Academic freedom in teaching lies in the fact that a teacher can independently develop a personalised approach for students in terms of the course design, content selection, methodology, form, tools, etc. Finally, it also involves forming relationships with students. It is crucial that these choices are made freely, yet with an awareness of alternatives (Sajdak, 2013, p. 19).

This article features a completed case study, representing unique application of three selected tools specifically designed for diagnosing and resolving the causes of problems. The tools were intentionally chosen to illustrate how causes are diagnosed using each of the proposed tools when applied to the same problem. This aimed to demonstrate how the tools can complement one another in the process of in-depth problem analysis. Three tools were selected.

The Ishikawa diagram, also known as a *cause-and-effect* diagram or a *fishbone* diagram, is one of the most widely used and effective traditional quality management tools. It was developed in the twentieth century by Kaoru Ishikawa and first applied in Japan by Sumitomo Electric. The diagram visually represents the relationship between effects and their potential causes across various categories. Over the years, the diagram has evolved. The diagram has been used to diagnose a variety of business problems, and refined with standard groups of causes common in manufacturing organisations. The most recognised classification of these groups, known as 5M+E, includes Machines, Methods, Materials, Management, Manpower and Environment. Occasionally, a separate category, *measurement*, was added alongside *Methods* (Hagemeyer et al., 2006; Kowalik, 2018; Szczęsna & Klimecka-Tatar, 2017; Szczęśniak et al., 2012).

The proposed Ishikawa diagram presented in this paper includes new problem categories specifically tailored to the given situation. These are instructor, students, university, course specificity, and teaching methods. Taking into account the traditional categorisations, the teacher and student groups can correspond to *manpower*, the course specificity group to *materials*, the teaching methods group to *methods* or *measurements*, and the university group to *management* or *environment*. A similar approach, involving the proposal of new categories, is adopted by Kuczaba-Flisak, who uses the diagram in her work with Polish studies students (Kuczaba-Flisak, 2022, p. 12).

The second tool is the Pareto diagram, which is primarily used in quality management. However, it is now employed in many scientific fields, as quality improvement pertains to virtually every aspect of daily life, not just professional domains. Its creator, Italian economist and sociologist Vilfredo Pareto, designed the diagram as a bar chart illustrating the distribution of causes and effects in a process. It highlights the uneven distribution between causes and effects, showing that a relatively small number of causes account for a significant portion of the effects. Typically, 20-30% of factors determine approximately 70-80% of the effects. Accurate diagnosis of the causes determines the effectiveness of preventative measures. An alternative name for this is the *20–80 rule*, or the *ABC method*. This diagram introduces a hierarchy of factors that directly impact the phenomenon under investigation (Chądzyńska & Klimecka-Tatar, 2017, p. 32; Dahlgaard et al., 2001; Jazdon, 2001, Strycharska et al., 2018 p. 263).

The third technique applied is 5W, also known as the *5 Whys*. Its primary goal is to ask the question 'why' five times to determine the cause of the problem. The 5W technique is part of the Japanese kaizen philosophy, which is based on the observation that no enterprise is perfect, and each one encounters specific problems (Czaczkowski, 2014, p. 146). The 5W technique is used to analyse cause-and-effect relationships. The number '5' in the name originates from the empirical observation of the number of iterations typically required to solve a problem; however, the exact number of iterations (asking 'why') is not crucial here. What is more important is to continue asking questions until the root cause of the problem is identified and eliminated. Like the Ishikawa and Pareto diagrams, the 5W technique is not only applied in quality management but also in areas such as coaching, to better understand the reasons behind actions taken or goals set (Czardybon, 2017, p. 115). A very important practical aspect when applying this tool is its ability to identify processes or aspects that can be modified or controlled to effect real change (Helman & Rosienkiewicz, 2016, p. 67–68; Serrat, 2017, p. 310).

Also, when diagnosing causes, both quantitatively and qualitatively, listening skills in open communication between students, the course instructor, and the year supervisor proved extremely helpful. Deep listening was found to be a competency that aids leaders and entrepreneurs in problem-solving, creating innovative solutions, and decision-making amidst the continuous volatility, uncertainty, complexity, and ambiguity characterising the modern world (the *VUCA* world) (Rędzińska, 2018, p. 100). Indeed, chal-

lenging situations present an excellent opportunity for practising this competency, particularly at the academic level.

The presented case study not only integrates selected quality improvement methods. It also leverages the resulting synergy to uncover the root causes of the problem and focus on them, saving time and increasing the chances of a better implementation outcome. As a result, the problem is thoroughly analysed, and identifying the root causes, rather than all possible causes, is a more effective means of preventing the problem from recurring.

Furthermore, combining methods necessitates communication, mutual openness, and honesty, fostering the development of future skills.

Description of the Problem and Selection of Tools to Solve it

In the academic year 2021/2022 at university 'X' in course 'A'[1], 50% of students[2] failed an examination in both term zero and terms 1 and 2. The issue became a topic of discussion not only among the students of the same cohort but also among older students, the year supervisor, and the course instructor. To address the problem, the year supervisor conducted interviews with students from the current cohort—those who passed, those who failed, and students from the previous cohort who had already passed the course, as well as the course instructor[3] From the interviews with students who failed the course, the year supervisor learned that in their opinion, the course instructor was too demanding, did not share notes, expected attendance, and required students to take their own notes. They also mentioned that the subject matter was challenging and required knowledge also from other courses to better understand the content. Additionally, during practical classes, not everything in the lab worked as expected. The test is multiple-choice, which requires additional focus not only on whether something is correct, but also on its logical consistency. In such conditions, according to the students, *getting a C is nothing short of a miracle*.

In turn, the year supervisor learned from the course instructor that students often used their phones during class instead of paying attention and were habitually late, and that those with an individual study plan frequently skipped classes (the university regulations allow exemption from attendance for part of the coursework). Also, full-time students were unwilling to share their notes with them. In addition, the instructor noted that while students preferred hybrid classes, during tasks or discussions, there was *radio silence*, as students were either commuting from work or at home distracted by pets or children. Moreover, gaps in knowledge from other courses exacerbated the difficulties in passing the course. *They need to catch up*, the instructor commented.

The year supervisor conducted sessions with students from an older cohort who had successfully completed course 'A' in the previous academic year. Upon asking their opinion, the supervisor learned that although the instructor was indeed demanding, all of the full-time students had managed to pass; they attended classes, refrained from sharing their notes with peers, and discussed issues directly with the instructor if there were any disagreements.

Given the situation, an anonymous survey[4] was conducted using Google Forms, also including feedback from students who passed the course and students from the previous cohort. Table 1 presents the number of responses and the reasons cited.

After analysing table 1, it was clear that the most common causes of the problems included:

- the issue of note-taking, the fact that the teacher does not share them, requiring students to create their own,
- the course is challenging, demanding additional knowledge,
- the vast majority of students prefer hybrid classes, which, as noted by the instructor, lead to further issues (lack of concentration); students believe the problem is complex.

After discussions with students who did not pass the course, certain conclusions came to light that might help to resolve the issue of the failed examination. No one reported any problems with how the

[1] The course 'A' is included in the curriculum of full-time studies with 30 hours of practical classes and 30 hours of lectures. Passing it is mandatory, and the lectures conclude with an examination.

[2] Out of a total of 200 students.

[3] The year supervisor held discussions with students once the semester had ended, following the board examinations for course 'A', which all students ultimately passed. The objective of the discussions, as well as the entire study, was to address the problem in order to prevent such situations from arising in the future. The supervisor spoke with students either before or after various practical classes, contingent upon his own availability according to the schedule. The discussions took place from February to mid-April 2022, and students also had the option to write or call the supervisor to express their opinions—however, no one exercised this option. However, students were eager to express their views in smaller groups, which is why the year supervisor spoke with each practical group from two cohorts. The conversation with the course instructor was conducted over the phone after the students failed the second attempt at the examination during the resit session.

[4] Out of 377 students across both cohorts, a total of 300 students participated in the survey. The survey was anonymous and featured a single multiple-choice question with options drawn from the reasons identified by the students and the academic instructor during the discussions, along with an open-ended *other reasons* option (no one provided additional reasons).

Table 1
Reasons for Failing the Course According to the Students

Reason	Number of indications
Full-time students do not share their notes with students who have an individual study plan	30
The subject matter is challenging, requiring knowledge not only from this course but also from others	180
The instructor requires attendance	15
Students must take notes themselves	270
The instructor does not distribute notes	300
Not everything is functioning in the lab	5
Multiple-choice test	20
Students lack knowledge from other courses	30
Being late for classes	15
The instructor is very demanding	20
During classes, the student commutes home (causing concentration issues)	15
Students prefer hybrid classes	223
I find it difficult to concentrate at home (with children and pets)	40
Unauthorised use of mobile phones during classes	80

Source: author's own work.

instructor graded the tests, so it is evident that the students failed because they did not provide correct answers. After their second attempt at the examination, the students claimed they were studying – using their notes and the materials they had—but they were studying. This raises suspicions about the quality of the notes they were using. The notes also pose a problem for students with an individual study plan (evidently, this is a bone of contention between full-time students and those with an individual study plan). Following the supervisor's suggestion, the instructor selectively reviewed these notes and found that the students with an individual study plan did not have complete materials, whereas errors were discovered in the notes of full-time students: items were misinterpreted, omitted, etc. Moreover, the full-time students did not share their notes with the students with an individual study plan, nor did the instructor distribute the notes to them.

The matter was not left unresolved. Both students and the instructor were asked why notes were not being shared. The instructor responded that these arrangements were made at the beginning of the course, no objections were raised, and taking notes is also a form of learning. Full-time students, on the other hand, found it to be unfair that those granted an individual study plan did not attend classes yet had the same conditions for passing as those who did attend.

The issue was resolved by implementing corrective actions targeting the key causes of the students' failure to pass the examination. As a preventative measure, the option for students to consult the instructor on their notes during office hours was introduced. The instructor also began sharing links and source materials, recommending books used during the classes, and made changes to the course completion requirements for students granted an individual study plan to make them feel fairer from the students' perspective.

Example of the Application of Selected Management Tools

To address the issue as effectively as possible, several management tools were employed. Initially, the Ishikawa diagram was used to display and categorise the groups of causes more effectively. This provided a global view of the problem and definitely made it easier to visualise it as a whole. Figure 1 presents an Ishikawa diagram for the problem of students failing an examination.

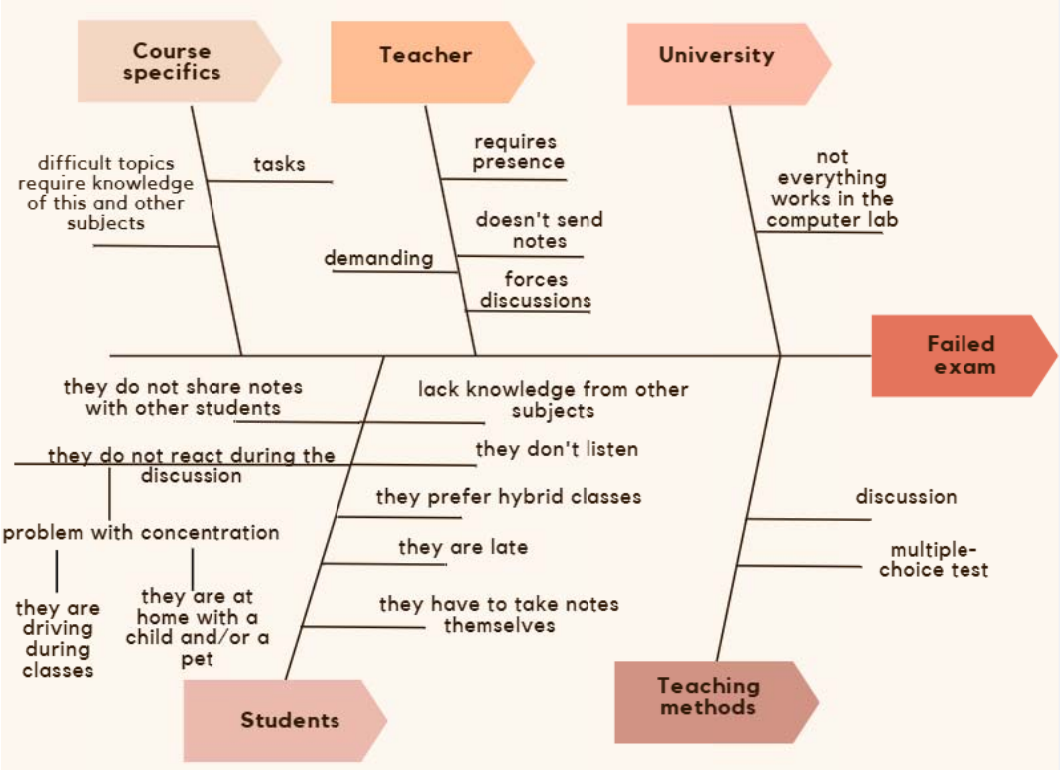
The Ishikawa diagram presented in figure 1 is proposed based on the description of the problem, drawing on data obtained from interviews and conversations with both the students and the course instructor, as well as the data in table 1.

Using the Ishikawa diagram enabled the visualisation of cause groups and helped to categorise them and to organise them systematically. However, in order to best resolve the situation, the focus was directed towards the key causes of the problem. To this end, a Pareto diagram was created from the survey data, and the resulting information is presented in table 2.

The data from table 2 is illustrated in figure 2.

The data from table 2 and figure 2, which present the results of the anonymous student survey, show clearly that 78.28% of all responses account for 28.57% of all reported reasons for failing the examination. These include the instructor not sharing notes, which automatically means that students have to take their

Figure 1
The Ishikawa Diagram for Students Failing an Examination



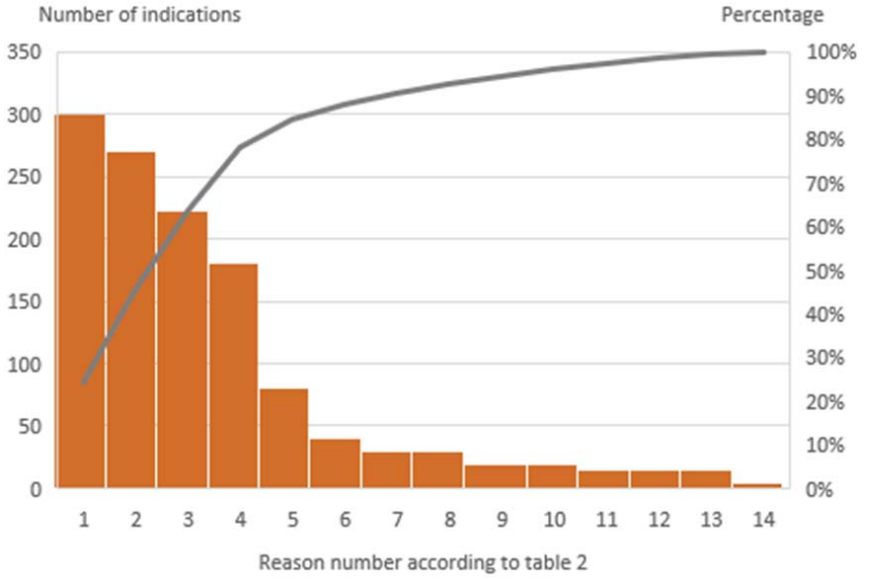
Source: author's own work using the Canva.

Table 2
Diagnosis of the Key Reasons for Failing an Examination using the Pareto Principle

No	Reason	Number of indications	Percentage	Cumulative Percentage
1.	The instructor does not distribute notes	300	24.14	24.14
2.	Students must take notes themselves	270	21.72	45.86
3.	Students prefer hybrid classes	223	17.94	63.80
4.	The subject matter is challenging, requiring knowledge not only from this course but also from others	180	14.48	**78.28**
5.	Unauthorised use of mobile phones during classes	80	6.44	84.71
6.	I find it difficult to concentrate at home (with children and pets)	40	3.22	87.93
7.	Full-time students do not share their notes with students who have an individual study plan	30	2.41	90.35
8.	I do not have information from other courses	30	2.41	92.76
9.	Multiple-choice test	20	1.61	94.37
10.	The instructor is very demanding	20	1.61	95.98
11.	The instructor requires attendance	15	1.21	97.18
12.	Being late to classes	15	1.21	98.39
13.	During classes, the student commutes home (causing concentration issues)	15	1.21	99.60
14.	Not everything is functioning in the lab	5	0.39	100.00

Source: author's own work.

Figure 2
Reasons for Failing an Examination According to the Number of Indications



Source: author's own work.

own; students preferring hybrid classes, which, despite being held outside the university, involve students participating from various locations and under different conditions; the fact that the subject matter is challenging and requires knowledge not only from this course but also from others. Consequently, focus was directed towards the core reasons by engaging in further discussions with both the students and the course instructor to examine these issues further (detailed findings from these investigations are included in the situation description). For this purpose, the *5 Why* technique was employed. For the fourth and fifth *whys*, logical connections between certain facts emerged from the discussions, resulting in expanded responses being added to these points as 4a and 4b, and 5a and 5b. The 5W technique is visualised in table 3.

Table 3 illustrates that in fact, the primary causes of the problem stemmed from the arrangements between the instructor and the group, as well as from the dynamics within the student group. As a preventative measure, the option for students to consult the instructor on their notes during office hours was introduced. The instructor also began sharing links and source materials, recommending books used, and

Table 3
Use of the 5W Technique to Examine the Issue of a Failed Examination

Problem	A student failed an examination	
1. Why	did the student fail the examination?	
Answer 1	The student did not provide correct answers on the test.	
2. Why	didn't the student provide correct answers on the test?	
Answer 2	The student had no materials to study from.	
3. Why	didn't the student have any materials to study from?	
Answer 3	It turned out that the student did not have complete notes.	
4. Why	didn't the student have complete notes?	
Answer 4a The instructor did not distribute notes.		Answer 4b The students were unwilling to share their own notes.
5a. Why didn't the instructor distribute notes?		5b. Why were the students unwilling to share their own notes?
Answer 5a These were the arrangements made at the beginning of the course (taking notes is also a form of learning).		Answer 5b They consider it unfair.

Source: author's own work.

made changes to the course completion requirements for students granted an individual study plan to make them feel fairer from the students' perspective. Thanks to these preventative measures, the pass rate for the course significantly improved in subsequent years. In the 2022/2023 academic year, all students passed either during the zero examination session or on the first attempt.

Summary and Discussion

The problem described in this study has practical applications and can serve as a ready-made case study for management-related courses. The analysed issue directly pertains to student affairs, enabling them to better understand the given situation, identify the underlying causes, and analyse and diagnose the interrelations more thoroughly. Furthermore, it allows them to see the benefits of combining several management methods. This synergy enables a more thorough problem analysis and a focus on the root causes, making prevention significantly more effective. The effect of synergy was also made possible through collaboration based on open communication, honesty, and above all, deep listening. Moreover, using three tools in the proper logical sequence enabled the true causes of the problem to be identified, while they were not immediately apparent. By selecting an appropriate order of tools, it was possible to focus on the root causes of the problem. As a result, the implemented preventative measures completely resolved the issue.

The presented case study has been used twice by the author in management-related classes. Several suggestions arose from observing how students worked with the material, which have been organised into three categories: didactic, substantive, and ethical.

The didactic category includes suggestions aimed at enhancing the understanding of the methods themselves, offering insights into the distinctions between them. It is recommended to start the class by presenting examples of each tool separately, without combining them. After discussing all the methods with various examples, the case study presented in the article should be divided into three parts, on separate sheets of paper (Ishikawa diagram, Pareto diagram, 5W technique). Students are informed that there will now be a case study demonstrating that it is possible to combine the methods. The class should start with a presentation of the problem (up to the paragraph beginning with *Given the situation...*), followed by the content from *Given the situation...* along with table 1. Finally, the content beneath table 1, starting with the sentence *After analysing table 1, it was clear that...* is discussed. For each section, a discussion should be conducted: What is this method? Why this method? Which information in the text helps apply this method? Brainstorming sessions or group discussions can be conducted, allowing students to share their opinions on a given problem after, for example, 15 minutes. Once the tool is correctly diagnosed, solutions can be visualised on the board or worked on in groups.

Suggestions in the substantive category focus on classifying causes into specific groups. During the diagnosis of individual groups of causes, particularly their names, various proposals may emerge that should be considered from the perspective of their substantive correctness. For example, with an Ishikawa diagram, causes can be diagnosed using the traditional 5Ms + E or 6Ms + E division, a new division (as shown in figure 1) can also be introduced, or two divisions may be overlaid, and, for instance, instructors and students may correspond to *manpower*, the course specificity to *materials*, teaching methods to *methods* or *measurement*, and the university to *management* or *environment*. Students can also be encouraged to propose their own logical groupings of causes and explain their reasoning. While the article demonstrates the use of selected tools, students can be asked what other tools could be applied to resolve the issue (the students failing an examination). They could also consider what additional information would be needed or whether the 5W2H technique could be used. This approach fosters discussion, analytical thinking, and creativity.

In the ethical category, it is suggested to focus not merely on the methods themselves, but on the comments, reactions, and statements from students that may emerge during the application or classification of the various causes, revealing the attitudes and values demonstrated by individual students. Since the case study directly concerns student issues, and one of the causes of the problem is a sense of unfair treatment, various comments, jokes, and questions often arise. This situation can be used as a platform for dialogue about different perspectives, viewpoints, and motives of the interested parties. The main benefit of such discussions is the reflection they provoke. When well-facilitated, this reduces tension within the group, fosters dialogue with instructors, and ultimately serves as a preventative measure against issues such as failing examinations.

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