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Introducing the Intensity of Influence in Decision-Making Style Analysis

Nikola KADOIĆ[1], Maja Gligora MARKOVIĆ[2], Tena JAGAČIĆ[1]

[1] University of Zagreb Faculty of organization and informatics, Varaždin, Croatia, nkadoic@foi.hr, tjagacic@foi.hr

[2] University of Rijeka Faculty of medicine, Rijeka, Croatia, majagm@uniri.hr

Background/Purpose: The examination of decision-making styles (DMS) is crucial for understanding how individuals approach choices and form preferences. Two influential frameworks in the DMS discourse, proposed by Scott & Bruce, and Rowe, provide insightful lenses for correlating dominant styles with an array of personal characteristics.
Methods: This comprehensive study delves into questionnaire results obtained in 2020 and 2022, employing methodologies aligned with Scott & Bruce, and Rowe. The survey targeted cohorts of business and military students, capturing nuanced aspects of decision-making. Introducing innovative concepts, namely submissive DMS and intensity of influence, expanded the analytical framework and facilitated a deeper understanding of decision-making dynamics.
Results: The analysis revealed substantial variations in decision-making styles within student populations, elucidating correlations with distinct personal characteristics. The incorporation of the intensity of dominance concept allowed for nuanced interpretations, particularly during the challenging COVID-19 period and the subsequent return to normalcy.
Conclusion: The integration of proposed concepts represents a significant enrichment for future research in the field of DMS. This study underscores the critical role of evolving methodologies in elucidating the intricacies of decision-making processes. The ongoing refinement of these methodologies promises a more nuanced understanding of how individuals navigate complex decision-making scenarios.

Keywords: *Decision-making style, Dominant, Submissive, Intensity of dominance, Students; Business, Army*

1 Introduction

Decision-making styles (DMSs) are the ways how people make decisions. Certain DMS can be observed through several aspects: the number of participants involved in the decision-making process, the duration of the decision-making process, tolerating uncertainty and risks in decision-making problems, the way of thinking (is it analytic, intuitive, or combined), and others. In literature, different researchers mostly focused on the way of thinking and the way of thinking. In our paper, the focus is on DMS with respect to the way of thinking. More precisely, we are focused on decision-making by Rowe (Rowe & Mason, 1987) and Scott & Bruce (Scott & Bruce, 1995). There are instruments developed for each of them that are used to determine the dominant DMS of individuals. When we know the dominant DMS of an individual, we can better understand their behaviour in certain situations:

- knowing our dominant DMS can help us in a way that we change our behaviour in situations when acting upon our dominant DMS will result in bad consequences for us. For example, if students' dominant DMS is dependent and they must make

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important decisions for their future, the result of applying dependent DMS in this situation might not be the best for them. But, knowing the fact that they are characterized by dependent dominant DMS can guide them to rethink the situation, and insist on making personal decisions by themselves, or at least to consult the right people for the decision, and then decide alone.

- Or, on the other hand, if students know the dominant DMS of other students they live or work with, they can predict the behaviour of students they live or work with. For example, if students must work together on a group project, and they know that one of the team members is characterized by delaying dominant DMS, which can result in the team not submitting the project on time, the team members can agree on setting up an earlier deadline for individual contributions.
- This paper's contribution is widening the analysis of the results of two instruments in two ways: analysing the submissive DMS and analysing the intensity of the dominant style over other styles in the instrument. Those two concepts are not investigated so far in the literature, and we believe that investigating those two components can be useful in scientific research and practical implications.
- The submissive DMS is the opposite term of the dominant DMS, it relates to the style an individual uses in less often situations. Like the benefits of knowing the dominant DMS, there are benefits of knowing which DMS we or someone else uses the least. We can have additional knowledge about ourselves and work on ourselves to make better decisions. On the other hand, if someone never uses a certain DMS, we can know how they will not act in certain situations. For example: if some students are characterized by a delaying style as submissive, other students will find them desirable in their teams.
- The intensity of dominance relates to the probability that someone will use their dominant DMS. Some individuals apply their dominant DMS in most cases, but others in just the relative majority of situations. Consequently, there is a need to measure how much a dominant style is dominant over other styles.

With this paper, we are upgrading the theoretical background of two DMS approaches and applying them in the case of the student population in Croatia trying to identify the differences in DMS profiles of students with respect to different characteristics that are related to demographic data (gender, age), type of student (business or army), the type of high school education and year when the questionnaire was filled out. So, the research questions related to our student sample are:

1. Is there a difference in the results obtained with DMS types by Scott & Bruce?
2. Is there a difference in the results obtained with DMS types by Rowe?
3. Is there a difference in the distribution of dominant DMS types by Scott & Bruce?
4. Is there a difference in the distribution of dominant DMS types by Rowe?
5. Is there a difference in the distribution of submissive DMS types by Scott & Bruce?
6. Is there a difference in the distribution of submissive DMS types by Rowe?
7. Is there a difference in the achieved results of the intensity of domination of the most dominant DMS over other styles by Scott & Bruce?
8. Is there a difference in the achieved results of the intensity of domination of the most dominant DMS over other styles by Rowe?

Introducing new concepts into the DMS theory enables us to analyse the data from new perspectives. In addition, this paper discusses the results of two different instrument applications in the student population. The new concepts introduced in this paper can be used in other types of respondents (managers, employees, volunteers, and others).

This paper is organized as follows: Section 2 briefly presents the most often analysed DMS with respect to the number of participants involved in the process and the way of thinking. Section 3 combines the previous research where different authors analysed the DMS of Rowe or Scott & Bruce. Section 4 presents new concepts in DMS theory (submissive style and intensity of dominance). In Section 5, we describe the methodology that was applied to answer the research questions. In Section 6, we present the results with a discussion and in Section 7 we conclude the research.

2 The DMS Approaches

2.1 DMS Concerning the number of participants

When discussing the number of people included in decision making, democratic and autocratic styles are two end-point styles. Between them, we can observe several different DMS that are sometimes closer to authoritarian styles and sometimes closer to democratic styles. Those styles can be graphically presented using Figure 1.

The figure aggregates the different DMS by Likert, Heller, Vroom, Yetton, Jago, Bass, Valenzi, Muna, and Ali (Ali, 1993; Kostanjevac et al., 2021; Lührs et al., 2018). SQ (status quo) represents the style where the decision is not made. In the autocratic I. style, one person makes the decision. In the delegation style, the making decision is forwarded to someone else. In autocratic II. style, the decision maker asks for specific information and then makes the decision alone. In consultative I. and II. styles, decision-makers ask for the opinions of other members, and they help make decisions. In the pseudo-consultative style, the decision has already been made by the decision maker. Still, the decision maker includes other participants and guides them to the same decision so that they feel like they influenced the decision. A similar situation is in the case of the pseudo-participative DMS. In democratic styles, all participants influence the final decision.

2.2 DMS concerning the way of thinking

When considering DMS with respect to the way of thinking, which is the focus of this paper, there are also several approaches.

The first approach is related to differing analytic, conceptual, behavioural, and directive styles. Initially, those styles were proposed by Rowe and Boulgarides and further investigated by Rowe, Mason, Robbins, Coulter, and others. They are in detail explained in the literature (Abdelsalam et al., 2013; Kostanjevac et al., 2021; Martinsons & Davison, 2007; Robbins et al., 2016). According to them, there are four types of DMS: direct, analytical, behavioural, and conceptual DMS (Rowe & Mason, 1987).

The direct DMS is characterized by a low tolerance for ambiguity and is task-oriented. The decision-making process is quick, with few alternatives and sufficient information (Pennino, 2002). In this style, individuals tend to direct others (Boulgarides, 1984). They are often authoritarian and somewhat aggressive but very effective at achieving results.

Unlike the direct style, the analytical DMS has a high tolerance for ambiguity, and each decision-making process involves an individual being conscientious. For their satisfaction, they enjoy challenges and are often in important positions within the company (Rowe & Mason, 1987). Analytical individuals are prone to logical and somewhat abstract thinking, which enables them to innovate in solving problems (Boulgarides, 1984). An analytical approach to decision-making enables decision-makers to look at problems from many perspectives (Pennino, 2002).

The conceptual style is human-oriented and implies high cognitive complexity. Many alternatives are considered when making decisions. Because of their orientation towards the future, they value quality and create common goals with their associates. They are very organised, independent, and actively involved in interacting with others, but they reject the pressure imposed (Rowe & Mason, 1987). They often initiate ethics and values and solve problems using intuition (Pennino, 2002). Behavioural DMS is characteristic of individuals who are empathetic and sympathetic to collaborators (Boulgarides, 1984). They develop listening skills, accept suggestions, and communicate easily with their interlocutors. When making decisions, they do not use data or analytics but are based on conversations and meetings with associates with a short-term orientation toward goals (Rowe & Mason, 1987).

There is an instrument, the Decision Style Inventory (DSI) by Alan Rowe which was designed to determine the decision style based on given answers in the test. The DSI test is used in the research part of this paper.

The second approach is related to DMS by Scott & Bruce. They identified five types of DMS: rational, intuitive, dependent, avoiding, and spontaneous. Each of these styles has typical characteristics.

A person with a rational DMS, as the name itself, tells each decision-making process of access in a reasonable manner, accompanied by a thorough analysis and logical evaluation of the alternative. There is also a commitment to research and finding quality information to understand the actual situation (Scott & Bruce, 1995).

The intuitive DMS follows the internal sentiment of a decision-maker. When making decisions, an intuitive person is devoted to analysing details based on his premonitions and feelings (Öngen, 2014).

The dependent style is characterized by the fact that it relies heavily on others. The advice, thinking, and experience of others make it possible to make a decision

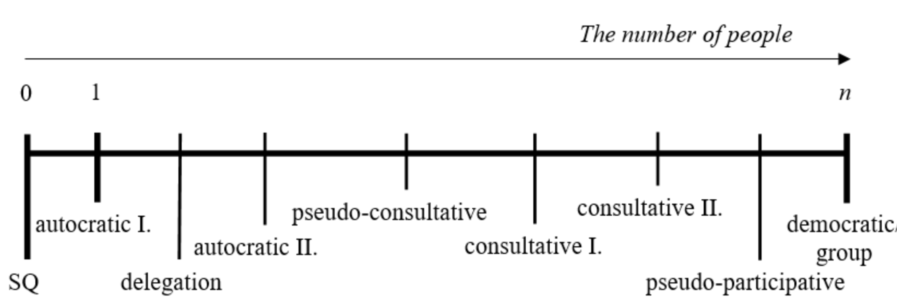

Figure 1: Systematization of the most common DMS with respect to the number of participants that are involved in the decision-making process (authors)

(Scott & Bruce, 1995). The dependent style indicates a lack of intellectual and practical independence (Varzaneh & Aliahmadi, 2015). Avoiding style tries to avoid making decisions. In addition to delays, the style is characteristic of last-minute decision-making (del Campo et al., 2016). The fifth style is the spontaneous style. In a spontaneous style, decision-makers tend to make hasty decisions with the desire to keep the decision process as short as possible (Parker et al., 2007).

To identify the dominant DMS of an individual, a validated instrument was created, i.e. the General Decision-Making style (GDMS) test. The GDMS was also used in this paper.

3 Previous Research

DMS are the subject of numerous studies, and their wide application can be seen in different research domains. Except in education, the decision-making instrument is applied in medicine, management, investment, and public administration services. Below we present an overview of the scientific contribution of both mentioned instruments.

By analysing the results of testing Turkish youth, Öngen (2014.) estimates the relationship between Vocational identity status, perfectionism, and decision-making style. The study was conducted on 317 Turkish university students and university graduates. The rational style was found to be a positive predictor of both career exploration and commitment. The dependent style is a positive predictor of career exploration, while the intuitive DMS is a positive predictor of commitment. It was confirmed that the intuitive style is a negative predictor of review, while the avoiding style is a positive predictor of reconsideration (Öngen, 2014).

A similar study was conducted at the University of Split. Students' demographic and psychological characteristics and DMS were considered. The questionnaire by Scott & Bruce was used during the study, and 77 students were examined. As in the previous study, the results show that women are more prone to intuitive and spontaneous decision-making than men. Given work experience, students with work experience are more inclined to the rational, intuitive, and evasive way of making decisions. Students who are more prone to achievement prefer a spontaneous DMS. When you look at the outcome of decisions and DMS, the most satisfied students are those who use a rational DMS (Bulog et al., 2017). To assess the psychometric properties of the Italian GDMS test, a study was conducted on 422 students at the University of Bologna. On the same occasion, 230 students completed the Italian variant of the SOLAT test, which assesses the style of learning and thinking. Based on the completed questionnaires, the data shows the reliability of the Italian variant of the GDMS test, and the correlations with the SOLAT questionnaire confirm this (Gambetti et al., 2008). The GDMS test was used to investigate the relationship between decision-making and cognitive styles measured by the Cognitive Style Inventory. The study involved 162 Iranian students. The study's main conclusion is that cognitive styles positively impact DMS (Motvaseli & Lotfizadeh, 2016).

The study's authors, which aim to understand the relationship between divergent thinking and DMS, found that a rational DMS plays a crucial role in divergent thinking. In addition, the hypothesis that the intuitive DMS is essential for divergent thinking has yet to be confirmed. The hypothesis that addicted and evasive styles are not involved in divergent thinking has been confirmed. The authors draw these conclusions based on data from 186 subjects and students of psychology in Italy (Palmiero et al., 2020). The effect of experiential learning on managers' strategic competencies and decision style was tested using Rowe's instrument. According to data from 22 surveyed executive MBA students, it was concluded that knowledge and strategic competencies could be improved through simulations of business strategies. However, practice only partially influences decision-making (Torres & Augusto, 2017). The GDMS test was also suitable for analysing the relationship between decision styles, the degree of self-judgment and working conditions among police investigators, and the stress, inclination to burn out, and quality of sleep. The survey included 203 police investigators from Sweden. The results suggest that avoiding and dependent DMS are related to higher self-esteem, burning-out tendencies, and poor sleep quality. Gender analysis has shown that men are more prone to rational decision-making and women to dependent decision-making (Salo & Allwood, 2011).

The scope of application of the GDMS test is shown by research on the relationship between DMS and emotional intelligence among police negotiators in crises, police officers and students. The survey is based on a sample of 438 participants, out of which 117 are hostage and crisis negotiators (HCNs), 118 are police officers and 203 are postgraduate students. The analysis results show that all police officers have a lower tendency to avoid decisions and a higher level of emotional intelligence than students. For all three groups of respondents, the rational style is their primary and secondary intuitive DMS (Grubb et al., 2018). The relationship between emotional intelligence (EQ) and DMS was observed in an Iranian survey involving 96 investors on the stock exchange. EQ and GDMS test results showed an association between EQ and rational and intuitive style, while no significant association was found between EQ and dependent, avoidance, and spontaneous style (Varzaneh & Aliahmadi, 2015).

Considering the DMS according to Scott & Bruce and the locus control, surveys were conducted on a sample of 365 Turkish managers. According to respondents' responses, the manager has a dominant rational DMS. It was noted that the internal control locus does not affect dependent and spontaneous DMS, has a positive impact on rational and intuitive style, and has a negative impact on avoiding DMS. The external locus of the controller does not affect the rational and dependent style, but it has a positive effect on the intuitive, avoiding, and spontaneous DMS (Akyürek & Guney, 2018). Pennino's research shows how 270 managers in the United States make decisions and how much they relate to their moral development. The Alan Rowe Decision style intervention (DSI) instrument was used to determine DMS. The study concludes that people using a direct style have less moral judgment (Pennino, 2002). The same tool was used in a study that looked at the DMS of the Dean in four higher education institutions in Malaysia. A total of 60 deans participated, and it was found that more than half of the deans received behavioural DMS, while analytical and conceptual styles were supportive (Jamian et al., 2013). Another example of using this instrument is how the hemisphere of the manager's brain influences decision-making. Based on a sample of 694 managers from three Malaysian universities, the results show that the first university is dominated by behavioural decision-makers who use the brain's right hemisphere when making decisions. The second university is dominated by analytical decision-makers using the brain's left hemisphere, and the third university is dominated by conceptual decision-makers using the brain's right hemisphere (Amzat, 2011). Investigating the connection between personality, DMS, and problematic smartphone use (PSU), based on three completed questionnaires (ZKA-PQ/SF, GDMS, and ATeMo) filled in by 1,562 research participants, it was found that avoiding, dependent, and spontaneous styles are positively correlated with PSU, the negative relationship is in case of rational style and null in the case of intuitive. In addition to the problematic use of smartphones, they are connected mainly by avoiding and spontaneous style (Urieta et al., 2023).

4 Submissive DMS and Intensity of Dominance

Previous research related to the application of Rowe and Scott & Bruce's DMS (using GDMS and DSI or upgraded instruments) was mostly related to identifying the dominant DMS per each approach. Additionally, researchers analysed connections and correlations between dominant DMS and other personal characteristics such as career prediction, position, emotional intelligence, or some behaviour.

In this paper, we are expanding the analysis of GDMS/DSI instruments results to the submissive style and the intensity of dominance of the dominant style. We describe those two concepts using the example in Figure 2, which presents the results of GDMS instrument application by two persons, A and B.

The submissive style is the opposite term of the dominant style. In GDMS and DSI results, an individual's submissive DMS is the style that is less characteristic of an individual, and the lowest result is achieved in that style. Analysing Figure 2, we can conclude that the dominant DMS of both A and B, using the Scott & Bruce approach, is rational style. In addition, the submissive style in both cases is the avoidant style. Defining the submissive style opens a whole new space for analysis of connections between the submissive style and different personal characteristics, like in the previous research. There are several benefits of analysing submissive styles. Here are some examples:

- Having the information that a specific submissive style characterizes an individual and that there is a positive correlation between a specific submissive style and some personal characteristics (ex. PSU) can motivate someone to take actions that will decrease PSU.
- If an individual knows that they are characterized by a specific submissive style (ex. spontaneous), but for their job is important to apply different practices in decision-making (ex. rational), it can motivate that person to change the behaviour and consequently DMS.
- Suppose two people are on opposite sides in the negotiation process, knowing that the opponent is characterized by a specific submissive DMS (ex., rational). In that case, an individual can plan their behaviour (use negotiation strategy or technique) that will request a rational approach from the opponent and, consequently, confuse the opponent and win the conflict.

The intensity of dominance (ID) is a measure of the dominance of the dominant DMS over others. In our example (Figure 2), both persons have the same dominant and submissive DMS. However, it does not mean that they apply the same decision-making strategies. It is important to observe the whole profile of GDMS results. In the case of person A, all styles are highly presented in behaviour (all results between 19 and 23). In person B's case, some styles are more often applied, and some less. The domination of rational style in A is lower than the domination of rational style in B. To quantify the ID, we can apply several approaches. Here, we will calculate it as the sum of differences between dominant decision style results (max_jDS) and results of other decision styles (DS_i).

$$ID_j = \sum_{i=1}^{5}\left(max_jDS - DS_i\right)$$

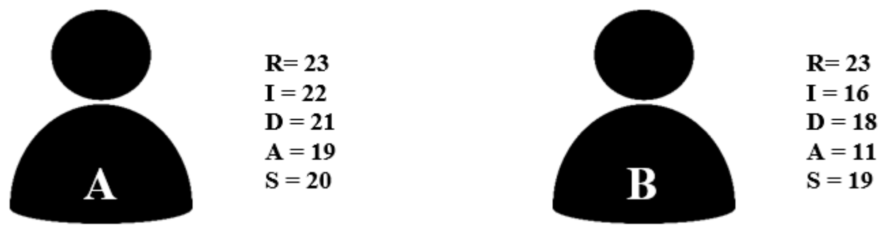

Figure 2: GDMS results of persons A and B

Table 1: Statistical methods applied per research questions

Research question	Statistical methods
Is there a difference in achieved results in DMS types by Scott & Bruce?	t-test, one-way ANOVA
Is there a difference in achieved results in DMS types by Rowe?	t-test, one-way ANOVA
Is there a difference in the distribution of dominant DMS types by Scott & Bruce?	χ^2 test
Is there a difference in the distribution of dominant DMS types by Rowe?	χ^2 test
Is there a difference in the distribution of submissive DMS types by Scott & Bruce?	χ^2 test
Is there a difference in the distribution of submissive DMS types by Rowe?	χ^2 test
Is there a difference in the achieved results of the intensity of domination of the most dominant DMS over other styles by Scott & Bruce?	t-test, one-way ANOVA
Is there a difference in the achieved results of the intensity of domination of the most dominant DMS over other styles by Rowe?	t-test, one-way ANOVA

If we apply the formula to the data in Figure 2, the results are: ID_A=10 and ID_B=26. Now, we can easily see the differences between persons A and B and see that the dominance of the dominant style is high, medium, or low. Higher ID means higher dominance of dominant style over others. Low ID can lead us to the conclusion that a person with low ID is characterized by no significant dominance of one style (with no dominant style) and can be the basis for introducing the hybrid DMS as a new possibility in the DMS divisions (both, Rowe, and Scot & Bruce). Here are some other thoughts regarding the ID and possible future research:

- It will be possible to seek the correlation between ID and other personal characteristics and create new knowledge,
- New knowledge about the individuals can be extracted by applying statistical tests to identify significant differences between subsets in different populations,
- It will be possible to evaluate the success of individuals' decision-making by connecting the ID and success, ex., if managers at the highest level in the organization have low ID, it means that they apply all DMS almost equally; however, it is not recommended that they often apply the avoidant or spontaneous style.

The DSI (Rowe styles) results for both concepts are similar to GDMS's interpretation. The formula of ID will count variable i from 1 to 4 since there are four DMS by Rowe.

5 Methodology of Research

After we explained the DMS and related instruments, previous research that applied those instruments, and after we defined new concepts (submissive DMS and the intensity of dominance), we will present the methodology that was applied to answer the research questions set up in the introduction. The research sample is related to undergraduate students: we have army students and business students from Croatia. The dataset consists of 263 students. Among them, some students filled out both questionnaires in 2020, and some filled out the questionnaires in 2022, and this will enable us to interpret the results in light of COVID-19.

The statistical methods that are applied in this research are presented in Table 1. In addition, descriptive statistics were used to describe the datasets and to present summative results related to achieved scores for both instruments, the distribution of dominant and submissive styles for both

Table 2: Datasets

Dataset	Description	Size	Dataset	Description	Size	Dataset	Description	Size
S1	joint 2020&2022 dataset	263	S4	Male subset of S1	85	S7	Army subset of S1	105
S2	2020 subset	138	S5	Female subset of S1	178			
S3	2022 subset	125	S6	Business subset of S1	158			

Table 4: Averaged scores per DMS (Bruce & Scott)

Scott & Bruce	S1	S2	S3	S4	S5	S6	S7
R - rational	19,859	19,594	20,152	19,365	20,096	20,032	19,600
I - intuitive	19,293	19,058	19,552	18,859	19,500	19,304	19,276
D- dependent	17,498	17,217	17,808	16,212	18,112	18,070	16,638
A – avoidant	12,817	12,529	13,136	12,318	13,056	13,671	11,533
S - spontaneous	14,734	14,717	14,752	14,941	14,635	14,342	15,324

Table 5: Averaged scores per DMS (Rowe)

Rowe	S1	S2	S3	S4	S5	S6	S7
D – directive	73,738	71,616	76,080	75,106	73,084	73,924	73,457
A – analytic	79,289	80,768	77,656	83,153	77,444	77,468	82,029
C – conceptual	75,243	76,130	74,264	74,129	75,775	76,316	73,629
B - behavioral	71,730	71,486	72,000	67,612	73,697	72,291	70,886

instruments and averaged values for the intensity of dominance for both instruments. The collected data were further analysed using MS Excel and Medcalc.

The research questions were analysed from the position of the described dataset and different subsets of the main dataset. They are presented in Table 2.

The data were collected through a survey that included two instruments GDMS (Scott & Bruce) instrument, the DSI (Rowe) instrument, and general questions about demographic and personal data: gender, age, the type of high school education, the type of student (army or economy) and year (when the data were collected).

6 Results with the Discussion

6.1 Demographic data about the respondents

The respondents' profile with respect to demographic and personal data is given in Appendix A. The number of female students is twice as high as the number of male students. The reason for that is the fact that the business study program is mostly enrolled by female students. Only a few male students enroll in business programs. In the case of army students, the situation is not the same in favour of male students. The respondents were mostly 20 to 24 years old at the time of data collection. About half of them finished the vocational high school program, and the other half are related to the gymnasium (grammar school). These results follow the census of the student population in the academic year 23/24 in Croatia. 151,827 students are studying in Croatia, almost 60% of whom are female. (Državni zavod za statistiku, 2023)

6.2 Analysis of DMS using the descriptive statistics

GDMS (Scott & Bruce) instrument consists of 25 questions. Five questions are related to different DMS. Here, respondents have to evaluate each question on a scale of 1 to 5 evaluating the level of agreement on how much something is related to them. Consequently, achieving up to 25 points for each DMS is possible. The dominant DMS is the one with the highest score.

DSI (Rowe) instrument consists of 20 instances with four possible answers for each (each is associated with one DMS). For each instance, respondents have to give 8 points to the answer that is mostly related to them, 4 points to their second choice, 2 points to the third choice, and 1 point to the last choice. Consequently, it is possible to achieve between 20 and 160 points per style (the sum of all responses is always 300).

Tables 4 and 5 present achieved averaged scores in both instruments and for all datasets.

As can be seen from the tables, the highest scores are achieved by rational and analytic styles, which is not surprising for a higher-education population. The lowest scores are achieved by avoidant style and behavioural style. The surprising result is related to behavioural style. Even in S6, business students, who have to work a lot in teams, apply this style (which is related to group decision making) the least. Since the study was conducted during the COVID-19 pandemic and general isolation, the lack of social activities may have an impact on behavioural style.

Tables 6 and 7 present distributions of the number of students per dominant DMS. Tables 8 and 9 present distributions of the number of students per submissive DMS.

Table 6: The distribution of students per dominant DMS (Bruce & Scott)

Scott & Bruce	S1		S2		S3		S4		S5		S6		S7	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
R	99	37,64	56	40,58	43	34,40	32	37,65	67	37,64	60	37,98	39	37,14
I	61	23,19	29	21,01	32	25,60	25	29,41	36	20,23	35	22,15	26	24,76
D	40	15,21	15	10,87	25	20,00	9	10,59	31	17,42	26	16,46	14	13,33
A	11	4,18	7	5,07	4	3,20	5	5,88	6	3,37	10	6,33	1	0,95
S	6	2,28	6	4,35	0	0,00	3	3,53	3	1,69	3	1,90	3	2,86
m	46	17,49	25	18,12	21	16,80	11	12,94	35	19,66	24	15,19	22	20,95

Table 7: The distribution of students per dominant DMS (Rowe)

Rowe	S1		S2		S3		S4		S5		S6		S7	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
D	47	17,87	17	12,32	30	24,00	14	16,47	33	18,54	34	21,52	13	12,38
A	93	35,36	55	39,86	38	30,40	36	42,35	57	32,02	52	32,91	41	39,05
C	62	23,57	39	28,26	23	18,40	22	25,88	40	22,47	36	22,79	26	24,76
B	58	22,05	26	18,84	32	25,60	12	14,12	46	25,84	35	22,15	23	21,91
m	3	1,14	1	0,73	2	1,60	1	1,18	2	1,12	1	0,63	2	1,91

Table 8: The distribution of students per submissive DMS (Bruce & Scott)

Scott & Bruce	S1		S2		S3		S4		S5		S6		S7	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
R	11	4,18	6	4,35	5	4,00	4	4,71	7	3,93	6	3,80	5	4,76
I	2	0,76	0	0,00	2	1,60	0	0,00	2	1,12	2	1,27	0	0,00
D	18	6,84	8	5,80	10	8,00	10	11,77	8	4,49	8	5,06	10	9,52
A	145	55,13	77	55,80	68	54,40	49	57,65	96	53,93	78	49,37	67	63,81
S	58	22,05	29	21,01	29	23,20	13	15,29	45	25,28	44	27,85	14	13,33
m	29	11,03	18	13,04	11	8,80	9	10,59	20	11,24	20	12,66	9	8,57

Table 9: The distribution of students per submissive DMS (Rowe)

Rowe	S1		S2		S3		S4		S5		S6		S7	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
D	70	26,66	42	30,44	28	22,40	18	21,18	52	29,21	46	29,11	24	22,86
A	45	17,11	18	13,04	27	21,60	8	9,41	37	20,79	32	20,25	13	12,38
C	46	17,49	24	17,39	22	17,60	17	20,00	29	16,29	21	13,29	25	23,81
B	95	36,12	51	36,96	44	35,20	40	47,06	55	30,90	55	34,81	40	38,10
m	7	2,62	3	2,17	4	3,20	2	2,35	5	2,81	4	2,53	3	2,86

Table 10: Analysis of averaged intensity of dominance

ID	Range	S1	S2	S3	S4	S5	S6	S7
Scott & Bruce	0-80	23,403	22,862	24,000	24,188	23,028	22,778	24,343
Rowe	0-340	91,992	106,188	76,320	94,600	90,747	89,601	95,590

Those results complement the previous conclusion: most students have rational and analytic styles as dominant and avoidant and spontaneous styles as submissive which is in line with the earlier study by Grubb et al. (2018). In this study, respondents were drawn from a group of people working in crisis management, police officers, and PhD students, i.e. members of a regulated profession and the business environment. Decision style with label m in both approaches indicates multiple dominant or submissive styles.

Table 10 presents achieved averaged results related to the intensity of dominance.

In the second column, we can see the theoretical range of DI in both instruments. In the case of GDMS (Scot & Bruce), the highest DI is achieved when one style is evaluated with a maximum of 25 points and all other (4) styles with a minimum of 5 points. The lowest DI is achieved when all styles are evaluated with an equal number of points. In the case of DSI (Rowe), the highest DI is achieved when one style is evaluated with the highest number of points (20 instances, 8 points – 160 points), the second style is evaluated with 4 points on all 20 instances (80 points in total), the third style is evaluated with 2 points on all 20 instances (20 points in total), and the last style is evaluated with 1 point on all 20 instances (20 points in total). ID, in this case, is 340. The lowest ID is achieved when each style achieved 8 points in five instances, 4 points in five instances, 2 points in five instances, and 1 point in five instances.

However, the presented cases when maximum DI values will be achieved are almost impossible in practice. In our study, the average DI in GDMS is around 23, and in the case of Rowe is around 90. In addition, we can see differences among subsets, ex., in the case of DSI (Rowe), DI(S2)=106 and DI(S3)=76. Data from S2 were collected at the beginning of the COVID-19 pandemic, and really, we can interpret this situation as the situation when people had to adjust to the new reality and strict rules. Adjusting and DI are very connected. Higher DI means having domination of DMS. And in the pandemic, there was a lot of need for adjustment to new situations and students applied their dominant decision-making styles in which they felt the most comfortable. In 2022, the situation was calmed, and there was no more need for adjustments than it was in 2020. DI is significantly decreased, which means that students can take some risks and apply different styles. So, we can conclude, that if there is a high need for adjustment to new conditions, students do not take risks in using all decision-making styles, but play safe with the style they feel the most comfortable.

6.3 Responding to research questions

1. Is there a difference in the results obtained with DMS types by Scott & Bruce?

To respond to the first research question data analysis according to the criteria of gender, high school, type of student, and year was performed with the t-test and according to the criteria of age with the one-way ANOVA. Due to the size of the summary matrix, we will not present all results of t-tests and one-way ANOVA but will present the results when statistically significant results are achieved, Table 11.

To conclude, there are some significant differences identified in the dataset. Mostly they are related to gender (female students achieve statistically significant higher scores than male students on rational and dependent styles), high school education (students who finished vocational high school programs achieve higher scores on rational and intuitive styles), and type of student (business students achieved higher scores on avoidant and dependent styles than army students).

2. Is there a difference in the results obtained with DMS types by Rowe?

To respond to the second research question, we applied t-tests and one-way ANOVA. Due to the size of the summary matrix, we will not present all results of tests but will present the results when statistically significant results are achieved, Table 12.

To conclude, there are some significant differences identified in the dataset. Mostly, they are related to gender (female students achieved significantly higher scores in behavioural and conceptual styles, and males in analytic style) which is in line with previous research by the author Bulog et al., 2017, conducted specifically with the student population and, type of students (army students achieved significantly higher scores in analytic style, and business students in conceptual and behavioural styles) which is expected because of the type of work the student is expected to do in the future, and year (students who filled the questionnaire in 2022 achieved significantly higher scores in directive style). The year 2022 is the year in which the pandemic was over, we returned to normal activities and social contacts, so a direct style is expected.

3. Is there a difference in the distribution of dominant DMS types by Scott & Bruce?

To answer the third question, χ^2 tests are implemented. The full results are presented in Table 13.

We identified eight statistically significant differences in the distribution of dominant DMS by Scott & Bruce with respect to four personal characteristics (gender, high school education, type of student, and year when the data were collected):

1. The distribution of dominant styles of male students is significantly different from that of female students when datasets for 2020 and 2022 are observed separately.
2. The distribution of dominant styles of students who finished vocational is significantly different from those of students who finished grammar school.
3. The distribution of dominant styles of business students is significantly different from that of army students in 2020 and in a set of male students.

Table 11: Statistically significant differences (Scott & Bruce)

Criteria	Gender						Age	Highschool education							Type of student						
Dataset	S1	S1	S2	S2	S3	S6	S4	S1	S1	S3	S3	S5	S6	S6	S1	S1	S1	S2	S3	S4	S5
Style	R	D	R	D	D	D	A	R	I	R	I	I	R	I	D	A	S	A	D	A	A
Value	f	f	f	f	f	f	23y	v	v	v	v	v	v	v	b	b	a	b	b	b	b
p-value	0,03	0,00	0,02	0,04	0,00	0,01	0,03	0,01	0,01	0,01	0,01	0,02	0,00	0,00	0,00	0,00	0,02	0,00	0,00	0,00	0,03

m-male; f-female; a-army; b-business; v-vocational

Table 12: Statistically significant differences (Rowe)

Criteria	Gender						Age	Type of student				Year						
Dataset	S1	S1	S3	S3	S3	S7	S1	S1	S3	S3	S3	S1	S4	S4	S5	S6	S7	S7
Style	A	B	A	C	B	B	A	A	A	C	B	D	D	C	A	B	D	B
Value	m	f	f	f	f	f	29 years	a	a	b	b	2022		2020		2022		2020
p-value	0,00	0,00	0,00	0,01	0,01	0,02	0,02	0,01	0,00	0,04	0,01	0,01	0,04	0,00	0,01	0,03	0,00	0,01

m-male; f-female; a-army; b-business

Table 13: The distribution of dominant DMS by Scott & Bruce

C	V	S1	S2	S3	S4	S5	S6	S7
Gender	χ^2	0,2156	**0,0391**	**0,0147**			**0,037**	0,2019
Age	χ^2	0,5364	0,6032		0,3117	0,3174	0,0881	0,7289
HSE	χ^2	**0,0455**	0,1958		0,481	0,1187	0,3367	0,0669
Type	χ^2	0,2681	**0,0043**	0,1483	**0,0314**	0,2583		
Year	χ^2	0,0533			0,1163	**0,0011**	**0,0009**	0,1209

4. The distribution of dominant styles of students who filled out the questionnaire in 2020 (during the COVID-19 pandemic) is significantly different from those of students who filled out the questionnaire in 2022, in the case of female and business students.

4. Is there a difference in the distribution of dominant DMS types by Rowe?

To answer the fourth question, χ^2 tests are implemented. The full results are presented in Table 14.

Here, we identified four statistically significant differences in the distribution of dominant DMS by Rowe with respect to two personal characteristics (age and year when the data were collected):

1. The distribution of dominant styles is significantly different among students with respect to their age in 2020.
2. The distribution of dominant styles of students who filled out the questionnaire in 2020 (during the COVID-19 pandemic) is significantly different from the distribution of students who filled out the questionnaire in 2022 in the case of all students, female students, and army students.

5. Is there a difference in the distribution of submissive DMS types by Scott & Bruce?

To answer the fifth question, χ^2 tests are implemented. The full results are presented in Table 15.

We identified four statistically significant differences in the distribution of submissive DMS by Rowe with respect to three personal characteristics (age, high school education, type of student):

1. The distribution of submissive styles is significantly different among students with respect to their age in the case of male students.
2. The distribution of submissive styles of students who finished vocational is significantly different from the distribution of submissive styles of students who finished grammar school in the case of students who filled out the questionnaire in 2022 and in the case of business students.
3. The distribution of submissive styles of business students is significantly different than the distribution of dominant styles of army students.

Table 14: The distribution of dominant DMS by Rowe

C	V	S1	S2	S3	S4	S5	S6	S7
Gender	χ^2	0,219	0,448	0,062			0,6683	0,0876
Age	χ^2	0,4365	**0,0312**	0,7111	0,4775	0,4519	0,7768	0,1175
HSE	χ^2	0,2803	0,344	0,7054	0,323	0,5899	0,2366	0,5442
Type	χ^2	0,3285	0,1327	0,2853	0,7804	0,1506		
Year	χ^2	**0,0247**			0,2138	**0,0226**	0,067	**0,046**

Table 15: The distribution of submissive DMS by Scott & Bruce

C	V	S1	S2	S3	S4	S5	S6	S7
Gender	χ^2	0,1431	0,1686	0,3279			0,344	0,8495
Age	χ^2	0,4244	0,0667	0,5649	**0,0071**	0,5478	0,8216	0,1552
HSE	χ^2	0,132	0,8537	**0,0286**	0,6764	0,3262	**0,0342**	0,8113
Type	χ^2	**0,0267**	0,0749	0,053	0,5054	0,2226		
Year	χ^2	0,5598			0,2841	0,7485	0,5711	0,181

Table 16: The distribution of submissive DMS by Rowe

C	V	S1	S2	S3	S4	S5	S6	S7
Gender	χ^2	**0,0342**	0,7724	**0,0042**			0,0735	0,5046
Age	χ^2	0,4209	0,6624	**0,0275**	0,1502	0,8889	0,8369	0,20650,
HSE	χ^2	**0,046**	0,1929	0,3051	0,3903	0,131	0,2368	0,5009
Type	χ^2	0,1155	0,1904	**0,0009**	0,7389	0,0954		
Year	χ^2	0,3179			0,1972	0,1933	0,0899	**0,0075**

Table 17: The analysis of intensities of dominance for Scott & Bruce and Rowe decision styles

C	Values	S1		S2		S3		S4		S5		S6		S7	
		ID (SB)	ID (R)	ID (SB)	ID (R)	ID (SB)	ID (R)	ID (SB)	ID (R)	ID (SB)	ID (R)	ID (SB)	ID (R)	ID (SB)	ID (R)
Gender		0,392	0,531	0,357	0,969	0,720	0,781					0,775	0,994	0,923	0,894
Age		0,7716	0,344	0,589	0,2656	0,8512	0,97	0,28	0,79	0,69	0,24	0,82	0,78	0,67	0,34
HSE	*p*	**0,019**	0,365	0,286	0,083	**0,027**	0,460	0,253	0,3508	**0,023**	0,758	**0,010**	0,709	0,276	0,489
Type		0,22	0,30	0,51	0,26	0,179	0,490	0,68	0,615	0,42	0,528				
Year		0,3701	**<,0001**					0,804	**0,010**	0,31	**<,0001**	0,573	**0,0009**	0,315	**<,0001**

6. Is there a difference in the distribution of submissive DMS types by Rowe?

To answer the sixth question, χ2 tests are implemented. The results are presented in Table 16.

Here, we identified six statistically significant differences in the distribution of submissive DMS by Rowe with respect to five personal characteristics (gender, age, high school education, type of student, and year when the data were collected): the distribution of submissive styles of male students is significantly different than the distribution of dominant styles of female students; the distribution of submissive styles is significant among students with respect to their age in 2022.; the distribution of submissive styles of students who finished vocational is significantly different than the distribution of dominant styles of students who finished grammar school; the distribution of dominant styles of business students is significantly different than that of army students in the case of 2022.; the distribution of dominant styles of students who filled out the questionnaire in 2020 (during the COVID-19 pandemic) is significantly different than those of students who filled out the questionnaire in 2022 in the case of army students.

7. Is there a difference in the achieved results of the intensity of domination of the most dominant DMS over other styles by Scott & Bruce?

8. Is there a difference in the achieved results of the intensity of domination of the most dominant DMS over other styles by Rowe?

Research questions 7 and 8 will be analysed together. Table 17 presents the results of t-tests and one-way ANOVA that were implemented to respond to those two research questions.

The results show that there are significant differences in ID with respect to two personal characteristics (high school education and year when the data were collected): Students who finished vocational high school achieved statistically significantly higher intensities of dominance than students who finished grammar school. It means students who finished vocational high school have significantly higher dominance of their dominant style over other styles. This is only true in the case of the Scott & Bruce instrument; Students who filled the DSI (Rowe) questionnaire in 2020 achieved statistically significantly higher intensities than students who filled the same questionnaire in 2022. This result additionally confirms previous discussions related to Table 10: in the COVID-19 period, students had to adjust their behaviour in terms of making decisions to new challenges that they suddenly faced.

7 Conclusion

In this paper, we gave the theoretical background of DMS and presented some previous research related to DMS defined by Scott & Bruce, and Rowe. So far, researchers were mostly oriented to the application of one instrument, and authors analysed dominant DMS. Additionally, they analysed connections (correlations) between decision styles and some personal characteristics of individuals. In our study, we deal with two instruments at the same time. Besides analysing dominant DMS, we proposed two new concepts in analysing DMS that were not analysed in the literature so far. They are submissive DMS and the intensity of dominance of dominant style(s) over others. The submissive DMS is the least often used decision style. Intensity of dominance is the level of dominance of the most often used DMS(s) over others. Both concepts can be included in future research in this field because their inclusion can contribute to discovering new knowledge and open new perspectives in concrete situations.

In the research part, we analysed the DMS of students that study in two fields: army and business. The data were collected in 2020 and 2022, which enabled us to interpret the results from the position of COVID-19 influence. The living and studying conditions in 2020 when the data were collected were very strict, so students had to adjust to strong rules which resulted in higher dominance of their dominant DMS over others.

Related to future research, having results of DMS per two instruments enables us to analyse the correlation among different variables:

1. Quantitative variables – we can calculate correlation coefficients among achieved scores per two instruments (R, I, D, A, S; D, A, C, B) and intensities of dom-

inance in both instruments. It means that we can make a square multivariate correlation matrix of all variables and see which constructs are correlated and which are not. It will be interesting to see if there are correlations among scores of DMS in the same instrument but also between the instruments, especially because the definitions of some DMS from different approaches are similar. Ex., are rational style scores (from Scott & Bruce's approach) correlated with analytic style scores (from Rowe's approach), or are two intensities of dominance in two instruments in correlation?

2. Quantitative variables – we can apply the if-then rules approach to see if there is: (1) the connection between dominant and submissive DMS in the same approach, (2) the connection between dominant styles respecting both approaches, (3) the connection between submissive styles respecting both approaches, (4) the connection between dominant and submissive styles respecting both approaches.

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Maja Gligora Marković works at the Faculty of Medicine at the University of Rijeka, Croatia, where she holds the positions of Assistant Professor and Head of the Department of Bioinformatics and Staff and Student development. She teaches subjects such as Medical Informatics, Health Informatics, Computer Assisted Medical Decision and Mathematics in Croatian and English. Her publication activity is mainly focused on information science, e-learning and decision making. She is also an executive editor of the scientific journal, The journal of the Polytechnic of Rijeka and a member of the editorial board of the scientific journal World of Health, the Bulletin of the Croatian Medical Informatics Society and the author or co-author of around 50 scientific and professional papers.

Nikola Kadoić has completed two undergraduate and one graduate studies at the Faculty of Organisation and Informatics. He works there as an Assistant Professor in courses related to decision-making. He is the author or co-author of around 50 scientific and professional papers. He was head of severalEU projects. He is regularly among the top ten percent of the best rated teachers at FOI, and according to a survey by the portal srednja.hr, he was the third best in Croatia. He was awarded the second prize for the best e-course at the University of Zagreb in 2012, the prize for social contribution and volunteering in 2014 and the Young Scholar Award of the international association EDEN and the Swedish association SVERD in 2017.

Tena Jagačić is a teaching assistant at the Faculty of Organization and Informatics, at the University of Zagreb, where she graduated from the Economics of Entrepreneurship programme. She is currently a PhD candidate in Information Sciences at the same university. Her professional development is focused on the development of new technological solutions that support decision-making in business and smart industry. She is a member of the Strategic Planning and Decision Laboratory. She is an assistant in the courses Business Decision Making and Design Thinking in Digital Transformation at the Faculty of Organisation and Informatics and in the Decision Analysis course in the Military Science programme at the University of Zagreb. She is active member of several significant projects, including HELA - Project of raising the maturity of higher education institutions for the implementation of learning analytics; project of the Faculty of Organization and Informatics entitled Regional Centre for pre-incubation in smart industry, and international Erasmus + project Women Entrepreneurs in Regional inclusive entrepreneurial ecosystems (WeRin).

Appendix A

Table appendix: Datasets description with respect to demographic and personal data

Criteria	Values	S1		S2		S3		S4		S5		S6		S7	
		No	%	No	%	No	%	No	%	No	%	No	%	No	%
Gender	Male	85	32,3	50	36,2	35	28,0					19	12,0	66	62,9
	Female	178	67,7	88	63,8	90	72,0					139	88,0	39	37,1
Age	20	31	11,8	26	18,8	5	4,0	19	22,4	12	6,7	1	0,6	30	28,6
	21	132	50,2	68	49,3	64	51,2	40	47,1	92	51,7	77	48,7	55	52,4
	22	69	26,2	30	21,7	39	31,2	13	15,3	56	31,5	57	36,1	12	11,4
	23	24	9,1	9	6,5	15	12,0	9	10,6	15	8,4	19	12,0	5	4,8
	24	6	2,3	4	2,9	2	1,6	3	3,5	3	1,7	3	1,9	3	2,9
	29	1	0,4	1	0,7	5	4,0	1	1,2	12	6,7	1	0,6	0	0
HSE	vocational	135	51,3	73	52,9	85	68,0	33	38,8	102	57,3	93	58,9	42	40,0
	gr. school	128	48,7	65	47,1	40	32,0	52	61,2	76	42,7	65	41,1	63	60,0
TSO	business	158	60,1	73	52,9	85	68,0	19	22,4	139	78,1				
	army	105	39,9	65	47,1	40	32,0	66	77,6	39	21,9				
Year	2020	138	52,5					50	58,8	88	49,4	73	46,2	65	61,9
	2022	125	47,5					35	41,2	90	50,6	85	53,8	40	38,1

HSE-high school education; TOS-Type of student