Discipline Factor and the Impact on Mathematics Learning Outcomes in Vocational High Schools

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Abstract. In general, the aim of the research was to examine the contribution of communication and motivation to Mathematics learning outcomes indirectly through learning discipline. Specifically, the objectives of this study were: 1) to examine the contribution of communication, motivation, and discipline to Mathematics learning outcomes; and 2) to examine the contribution of communication and motivation to the discipline of learning mathematics. The type of the research is correlational quantitative. The populations of the study were 704-grade X students of SMK Negeri 1 Jenang Ponorogo. The research’s samples were 255 students determined by the Slovin formula. The sampling employed proportional random sampling by lottery. The data analysis technique used was path analysis. The results of the study are: 1) interindividual communication, learning motivation, and learning discipline did not contribute simultaneously at α = 0.05 to mathematics learning outcomes; 2) interindividual communication and learning motivation contribute simultaneously to learning discipline at α = 0.05 (with the amount of the contribution of 31.8%; and 3) communication between individuals affects Mathematics learning outcomes indirectly through learning discipline at α = 0.05, amounting to 0.514. Learning motivation affects Mathematics learning outcomes indirectly through learning discipline at α = 0.05, amounting to 0.09.

1. Introduction
Mathematics learning outcomes play an important role in a student's career. This statement is in line with a belief that learning outcomes is related to the quality of human resources and of course has an important role in the progress of a nation [1]. According to [2], learning outcomes are abilities that students have after receiving their learning experiences. Furthermore, learning outcomes can be classified into three, namely: 1) skills and habits, 2) knowledge and understanding, and 3) attitudes and ideals. To achieve and keep pace with these developments, the students can be supported by qualified education. Education is something that everyone must experience either formally or informally. The education obtained can create a better future for the nation's children.
Mathematics education is an education that can create a better future for the nation's children. [3] proposed that mathematics is among the factors that play a role in the development of science and technology which can be used as a tool to apply it to the field of mathematics itself and to other fields of science. This supports [4] who stated that mathematics is a way to find answers to problems faced by humans. It means that the essence of mathematics is a way that can help humans to find solutions to an existing problem.

Those are the importance of mathematics. However, in reality, many students find it difficult to learn mathematics. Based on the data from the Education Center of the Ministry of Education and Culture, in 2017, the average score of mathematics was 49.08. Then, in 2018, it became 35.47, while in 2019, the average score for the National Examination was 37.11. It can be seen that from year to year, the average score for Mathematics in National Examination experienced the most drastic fall in 2018. Based on the documentary analysis, the average score of the results of Mathematics in the National Examination at SMK Negeri 1 Jenang Ponorogo in 2018/2019 has not fulfilled the expectation, namely 42.53.

The level of mathematics learning outcomes of a student is influenced by both the environment/outside the students and by themselves. The factor from outside the students which is strongly believed to affect it is interindividual communication. In learning mathematics, communication between individuals is needed. This communication occurs between students and students or students and teachers. Without good personal communication skills, relationships between individuals in mathematics learning cannot develop properly, so in turn, learning difficulties cannot be minimized [5]. According to [6], interpersonal communication (between individuals) is an activity in exchanging information and meaning carried out by two or more people on the basis of knowing each other, trusting, respecting, belonging, and feeling happy.

Factors from within students which are thought to have a very strong influence on mathematics learning outcomes are learning motivation and discipline. Students' motivation to be encouraged and have high expectations in learning mathematics is crucial. According to [7], motivation is an urge in the form of movement caused by the existence of a target, high enthusiasm, and persistent efforts to achieve it. Meanwhile, [8] claimed that low motivation will make someone lazy or reluctant to do something because there is no energy that encourages them to do something. On these grounds, it can be concluded that learning motivation comes from within students with the characteristics of students being driven, having hope, and having incentives (rewards or punishments).

Discipline in learning is a core character that every student must have in learning mathematics. If students have a disciplined attitude, they will comply with all existing rules and be on time during the learning process. Discipline can be defined as individual awareness of duties, obligations, and rules; with the characteristics shown in individual behavior both in controlling and directing themselves according to their environment [9].

Based on the elaboration, the aim of the study in general is to examine the contribution of communication and motivation to mathematics learning outcomes indirectly through learning discipline. There are two specific purposes of this research: 1) testing the contribution of communication, motivation, and discipline to mathematics learning outcomes and 2) examine the contribution of communication and motivation to the discipline of learning mathematics.

2. Method
Based on the approach, the type of this research is quantitative research with correlational research design. [10] argued that quantitative research uses numerical data and emphasizes the research process on measuring objective results using statistical analysis. The focus of quantitative research is collecting data and analyzing it and making generalizations to explain specific phenomena experienced by the population. Furthermore, [11] stated that correlational research is a study that involves activities to determine the relationship and level of the relationship between two or more variables.
The populations of this study were 703-grade X students of SMK Negeri 1 Jenang Ponorogo of the academic year of 2019/2020. The samples of this study were 255 students. The number of the samples was determined by the Solvin formula, i.e.

\[ n = \frac{N}{1 + Ne^2} \]

Note: \( n \) = sample size, \( N \) = population size, and \( e \) = percent leeway in inaccuracy due to tolerable or desirable sampling errors, 1% - 5% [11].

The sampling technique used was proportional random sampling by lottery. The data collection techniques were by using questionnaires and documentation. The questionnaire was used to collect the data on communication, motivation, and learning independence. Questionnaire is defined as a data collection technique in the form of a list of statements/questions given to other people who are willing to respond (respondents) according to the request of the researcher [12]. Before the questionnaire was used, the validity and reliability were tested. The validity of the questionnaire examine to what extent the measurement is precise in measuring what is to be measured, while the reliability questions to what extent a measurement can be trusted because of its consistency [13]. Meanwhile, the documentation method was used to retrieve data on mathematics learning outcomes in the form of the 2019/2020 Odd Semester Final Assessment scores.

The data analysis techniques used was path analysis technique. The analysis process consists of several stages, namely prerequisite tests, path analysis techniques, and hypothesis testing. Path analysis is used to describe and test the relationship model between variables in the form of causation [14]. In this path analysis, there were four variables tested, namely learning communication (X1), learning motivation (X2), learning discipline (Y), and mathematics learning outcomes (Z).

3. Result and Discussion

Data on communication variables (X1), motivation (X2), and learning discipline (Y) obtained from filling out a questionnaire of 15 items each, as well as data on mathematics learning outcomes obtained from the analysis of the value document from a sample of 255 students are briefly presented in figure 1.

![Figure 1. Summary of the Data of the Research](image)

Based on the frequency distribution of each research variable, if classified as low, medium, and high, then it is concluded that for the communication variable there are 83 students (32.55%) in the low category, 97 students (38.04%) in the moderate category, and 75 students (29.41%) in the high category. Meanwhile, the motivation variable shows that 77 students (30.19%) are in the low category, 102 students (40%) are in the medium category, and 76 students (29.81%) are in the high category. In discipline variable, there are 84 students (32.94%) in the low category, 88 students (34.51%) in the medium category, and 83 students (32.55%) in the high category. Then, the learning outcomes
variable contained 81 students (31.76%) in the low category, 105 students (41.18%) in the medium category, and 69 students (27.06%) in the high category. Based on the five aforementioned variables, the average level of the sample students of SMK Negeri 1 Jenang Ponorogo is moderate. This is different from the research by [15] which indicated that the level of achievement of class VIII students of SMP Negeri 26 Satu Atap Pallantikang was in the low category. This difference may occur due to the different levels of school units.

Prior to the path analysis, the data that have been obtained were subjected to a prerequisite test. The prerequisite tests consisted of normality test, linearity test, multicollinearity test, heteroscedasticity test and auto correlation test. The result of the normality test on the Kolmogorov-Smirnov value of communication variable was 0.162, 0.332 for the motivation variable, 0.53 for the discipline variable, and 0.210 for the learning variable. The significance value of these five variables was 0.05, which indicates that all the research variables were normally distributed.

The linearity test shows that the value of $F_{value}$ for the communication variable on discipline is 1.370 with $F_{table}$ of 1.576. The motivation variable for discipline has an $F_{value}$ of 1.047 with an $F_{table}$ of 1.565. In the communication variable on the result of learning mathematics, the value of the $F_{value}$ is 0.787 and the $F_{table}$ is 1.576. The motivation variable for learning mathematics outcomes is the value of $F_{value}$ of 1.161 with $F_{table}$ of 1.565. in the discipline variable towards mathematics learning outcomes, the value of the $F_{value}$ is 1.172 with the $F_{table}$ of 1.565. The data is said to be linear if $F_{value} < F_{table}$, it means that the relationship of all these variables is linear.

The multicollinearity test for communication and motivation variables has a VIF value of 1.370 with a TOL (tolerance) value of 1.576. For communication and discipline, the VIF value is 1.456 with a TOL value of 0.687. For motivation and discipline, the VIF value is 1.476 with a TOL value of 0.657. For discipline and mathematics learning outcomes, the VIF value is 1.004 with a TOL value of 0.996. According to [16], to be free from multicollinearity problems, a tolerance value must be higher than (>0.10 and a VIF value must be lower than (<)10. It can be concluded that the data of this study did not have multicollinearity symptoms in the regression model.

The result of the heteroscedasticity test shows that the significance value of the communication variable on discipline is 0.928 and the motivation variable for discipline is 0.280. Both of these variables have a significance value above 0.05, so there are no symptoms of heteroscedasticity for these variables on the discipline variable. For the communication variable on learning outcomes, it has a significance value of 0.842; 0.729 for the motivation variable on learning outcomes; and 0.832 for the discipline variable on learning outcomes. The three variables have a significance value above 0.05, so these variables have no symptoms of heteroscedasticity on learning outcomes.

In the autocorrelation test, the Durbin-Watson value for communication and motivation variables for discipline is 1.865. For communication, motivation, and discipline variables on learning outcomes, the Durbin-Watson value is 1.988. The two values are more than the DL value and less than the 4-DU value, so the data in this study are not autocorrelated.

After the prerequisite test was met, a path analysis was then carried out. The results of the path analysis in the form of the amount of contribution between variables through the coefficient value ($\rho$) on each path are presented in Figure 2.

![Figure 2. Path Coefficients](image)

Based on Figure 2, it is obtained two multiple linear regression equations as follows:
a. The first equation: \[ Z = (-0.156)X_1 + (0.052)X_2 + (0.006)Y + (0.983)\epsilon_1 \] with the interpretation that if communication (X1) has increased by 1 point while the other variables are constant, it will reduce mathematics learning outcomes (Z) by 0.156. If each motivation (X2) increases by 1 point while the other variables are constant, it will increase mathematics learning outcomes (Z) by 0.052. For discipline (X3), each increase by 1 point while the other variables remain, it will increase mathematics learning outcomes (Z) by 0.006.

b. The second equation: \[ Y = (0.509)X_1 + (0.090)X_2 + (0.682)\epsilon_2 \] with the interpretation that if communication (X1) increases by 1 point while the other variables are constant, it will increase discipline (Y) by 0.509. Every time motivation (X2) increases by 1 point while the other variables are constant, it will increase discipline (Y) by 0.090.

The first hypothesis test using the simultaneous significance test (F-test) obtained F-value of 1.459 with F (0.025; 3; 251) of 3.168. This shows that F-value < F-table. It can be concluded that H0 is accepted. In other words, communication, motivation, and discipline do not contribute simultaneously towards mathematics learning outcomes with \( \alpha = 0.05 \). Communication, motivation and discipline altogether cannot improve mathematics learning outcomes. The results of this study are not in line with the results of [17] study which stated that there was a significant positive relationship between student’s learning motivation and mathematics learning outcomes. Likewise, it is not in line with the results of [18] which concluded that there was a positive effect of discipline on student’s achievement. This difference occurs because the research conducted has several limitations. The limitations of this research include, for example, vocational high school students and the filling of the instruments are not strictly controlled. The tendency of vocational school students to dislike mathematics makes it possible that in filling out the questionnaire, they did not have full concentration.

The second hypothesis test obtained F-value of 58.868 with F (0.025; 3; 251) of 3.168. In other words, the F-value > F-table, which indicates that the H0 is rejected. It means that communication and motivation contribute simultaneously to discipline with \( \alpha = 0.05 \). The results of this study are in line with the results of research by [8] which concluded that motivation had a partial effect on student discipline with a significance value of 0.017 < 0.05. Because H0 is rejected, it can be continued with a partial test using the t-test. The partial test results are presented in table 1.

| Model | Unstandardized Coefficients | Standardized Coefficients | t | Sig. |
|-------|----------------------------|---------------------------|---|-----|
|       | B          | Std. Error | Beta |
| 1     | (Constant) | 17.282     | 2.582 | 6.694 | .000 |
|       | X1         | .487       | .060  | .509  | 8.087 | .000 |
|       | X2         | .082       | .058  | .090  | 1.422 | .156 |

a. Dependent Variable: Y

Based on table 1, it can be stated that the t-value for the communication variable (X1) is 8.087 with a significance of 0.000, so there is a rejection for H0 because the significance value is less than 0.05. It means that partially, communication contributes significantly to discipline. The results of this study are in line with the results of [19] study which stated that interpersonal communication has a direct effect on work attitudes, meaning that increased interpersonal communication causes an increase in teacher work attitudes. Likewise, the research results of [20] concluded, among other things, there was an effect of student’s discipline on student achievement of SMA/MA students in Mataram City of 7.8%.
For the motivation variable (X2), the F-value is 1.422 with a significance of 0.156, so H0 is accepted, because the significance value is more than 0.05. It means that partially, motivation does not contribute significantly to discipline. The results of this study are not in line with the results of research by [21] which concluded that there was an effect of work motivation on employee’s work discipline in Sukakarya Village, Tarogong Kidul District, Garut Regency. Likewise, it is not in line with the research results of [22], which concluded that, among other things, work motivation had a positive effect on employee discipline of PT. PLN East Java Distribution Malang Area. With the limitations of this study as it is previously stated, it can be interpreted that partially, learning motivation contributes significantly to discipline at the 15.6% significance level.

The results of the path analysis show that the contribution is direct or indirect. Communication variable affects mathematics learning outcomes indirectly through discipline by 0.514. Meanwhile, the motivation variable affects learning outcomes indirectly through discipline by 0.096. The results of this study are supported by the results of the research by [23] & [24], which concludes, among other things: 1) communication has a positive and significant effect on the performance of the employees of the Education Quality Assurance Institute in Central Sulawesi Province; 2) motivation has a positive and significant effect on the performance of the employees of the Central Sulawesi Province Education Quality Assurance Agency; and 3) work discipline has a positive and significant effect on the performance of employees of the Central Sulawesi Province Education Quality Assurance Institute.

4. Conclusion
Interindividual communication, learning motivation, and learning discipline do not contribute simultaneously at α = 0.05 to mathematics learning outcomes. The cause of the absence of the simultaneous contribution is this study’s limitations, namely the samples were vocational school students and the filling out of the instruments was not strictly controlled. The tendency of vocational students to dislike mathematics makes it possible not to have full concentration during the filling out of the instrument. Interindividual communication and learning motivation simultaneously contribute to critical thinking skills at α = 0.05. The amount of contribution of interindividual communication and learning motivation to the discipline of learning mathematics is 31.8%. Communication between individuals affects mathematics learning outcomes indirectly through learning discipline at α = 0.05, amounting to 0.514. Meanwhile, learning motivation affects mathematics learning outcomes indirectly through learning discipline at α = 0.05, amounting to 0.09.

Acknowledgement
We would like to express our gratitude to various parties who have supported this research activity. Our gratitude goes to the Directorate of Research and Community Service, Directorate General of Strengthening Research and Development of the Ministry of Research, Technology and Higher Education who has assisted in funding the costs of this research. Our gratitude also goes to the Director of the Postgraduate School and the Chairperson of the Research Institute at the Muhammadiyah University of Surakarta and the staff, who have provided facilities and encouragement so that we can conduct this research. Our gratitude also goes to the head of the Education Office, the head and teachers of SMK Negeri 1 Jenang Ponorogo, who have helped the research process so that it went according to the plan.

References
[1] Sutama and B. Anggitasari, “Gaya dan Hasil Belajar Matematika Pada Siswa SMK,” J. Manag. Pendidik., vol. 13, no. 1, pp. 52–61, 2018.
[2] N. Sudjana, Penilaian Hasil Proses Belajar Mengajar. Bandung: PT Remaja Rosdakarya, 2013.
[3] M. D. Siagian, “Kemampuan Koneksi Matematik dalam Pembelajaran Matematika,” MES (Journal Mat. Educ. Sci.), vol. 2, no. 1, pp. 58–67, 2016.
[4] Hasratuddin, “Membangun Karakter Melalui Pembelajaran Matematika,” *J. Parad.*, vol. 6, no. 2, pp. 130–141, 2013.

[5] T. A. Awad and S. Alhashemi, “Assessing The Effect Of Interpersonal Communications On Employees’ Commitment And Satisfaction,” *Int. J. Islam. Middle East. Financ. Manag.*, vol. 5, no. 2, pp. 134–156, 2019.

[6] R. Hidayat, “Peningkatkan Aktivitas Komunikasi Interpersonal Dalam Organisasi Melalui Perbaikan Efikasi Diri, Kepemimpinan Dan Kekohesifan Tim,” *J. Manaj. Pendidik.*, vol. 4, no. 2, pp. 161–170, 2017.

[7] S. Hamdi and A. Abadi, “Pengaruh Motivasi, Self-Efficacy dan Latar Belakang Pendidikan Terhadap Prestasi Matematika Mahasiswa PGSD STKIP-H dan PGMI IAIH,” *J. Ris. Pendidik. Mat.*, vol. 1, no. 1, pp. 77–86, 2014.

[8] Y. Yanti and Marimi, “Pengaruh Motivasi, Lingkungan Keluarga, Dan Teman Sebaya Terhadap Kedisiplinan Siswa,” *Econ. Educ. Anal. J.*, vol. 6, no. 2, pp. 329–338, 2016.

[9] F. Kristin and F. K. Sari, “Pengaruh Kedisiplinan Belajar Terhadap Hasil Belajar Mahasiswa dalam Mata Kuliah Konsep Dasar IPS,” *J. Pendidik. Ilmu Sos.*, vol. 28, no. 1, pp. 31–37, 2019.

[10] Sutama, *Metode Penelitian Pendidikan: Kuantitatif, Kualitatif, PTK, Mix Method, R&D*. Sukoharjo: CV Jasmine, 2019.

[11] Sutama, *Metode Penelitian Pendidikan Kuantitatif, Kualitatif, PTK, dan R&D* Temanggung: Fairuz Media, 2019.

[12] Riduwan, *Belajar mudah penelitian untuk guru, karyawan dan peneliti pemula*. Bandung: Alfabeta, 2010.

[13] F. Yusup, “Uji Validitas Dan Reliabilitas Instrumen Penelitian Kuantitatif,” *J. Tarb. J. Ilm. Kependidikan*, vol. 7, no. 1, pp. 17–23, 2018.

[14] Sugiyono, *Metode Penelitian & Pengembangan Research and Development*. Bandung: Alfabeta, 2014.

[15] Hajar and I. Suryaningsih, “Peningkatan Hasil Belajar Matematika Standar Kompetensi Lingkaran Melalui Metode Kinestetik Pada Peserta Didik Kelas VIII.B SMPN 26 Satu Atap Pallantikang, Kecamatan Maros Baru, Kabupaten Maros,” *J. Pendidik. Biol.*, vol. 4, no. 1, pp. 119–136, 2016.

[16] I. Ghozali, *Aplikasi Analisis Multivariate dengan Program SPSS*. Semarang: Universitas Diponegoro, 2011.

[17] Jatmiko, “Hubungan Motivasi Belajar Dengan Hasil Belajar Matematika Siswa Kelas X SMK Nahdhatul Ulama Pace Nganjuk,” *J. Math Educ. Nusant.*, vol. 1, no. 2, pp. 205–213, 2015.

[18] L. D. Wulandari and S. Hapsari, “Pengaruh Kedisiplinan Terhadap Prestasi Belajar Siswa Mata Pelajaran Ekonomi Kelas XI Pada Siswa SMA Negeri 4 Depok,” *Judika (Jurnal Pendidik. UNSIKA)*, vol. 5, no. 2, pp. 148–151, 2017.

[19] Elfridauli, “Pengaruh Budaya Organisasi Dan Komunikasi Interpersonal Terhadap Sikap Kerja Guru SMP Swasta,” *J. Manaj. Pendidik.*, vol. 5, no. 1, pp. 96–106, 2018.

[20] N. Amalda and L. Prasojo, “Pengaruh Motivasi Kerja Guru, Disiplin Kerja Guru, Dan Kedisiplinan Siswa Terhadap Prestasi Belajar Siswa,” *J. Akuntabilitas Manaj. Pendidik.*, vol. 6, no. 1, pp. 11–21, 2018.

[21] R. Pratama and Nurbudiawati, “Pengaruh Motivasi Kerja Terhadap Disiplin Kerja Pegawai di Kelurahan Sukakarya Kecamatan Tarogong Kidul Kabupaten Garut,” *J. Pembang. dan Kebijak. Publik*, vol. 07, no. 02, pp. 10–19, 2016.

[22] H. T. Farid, D. Hamid, and G. E. Nurtjahjono, “Pengaruh motivasi kerja terhadap
kedisiplinan dan kinerja pegawai PT. PLN distribusi Jawa Timur area Malang,” *J. Adm. Bisnis*, vol. 32, no. 1, pp. 75–81, 2016.

[23] Prayitno, H. J., Kusmanto, H., Nasucha, Y., Rahmawati, L. E., Jamaluddin, N., Samsuddin, S., & Ilma, A. A. (2019). The Politeness Comments on The Indonesian President Jokowi Instagram Official Account Viewed From Politico Pragmatics and The Character Education Orientation in The Disruption Era. *Indonesian Journal on Learning and Advanced Education (IJOLAE)*, 1(2), 52–71.

[24] S. Alam, “Pengaruh Komunikasi, Motivasi, dan Disiplin Kerja Terhadap Kinerja Pegawai Lembaga Penjaminan Mutu Pendidikan,” *e-Jurnal Katalogis*, vol. 2, no. 1, pp. 135–145, 2014.