# Contribution of Students' Learning Motivation and Numerical Ability to The Learning Outcomes of Chemistry Calculations During the Pandemic.

## [1]Sri Rastuti

Senior High School 1 Karangdowo, Klaten, Central Java, Indonesia
E-mail Correspondence: *rastutisri023@gmail.com*

| Article Info | Abstract |
|---|---|
| *Article History*<br>*Received: 07 March 2022*<br>*Revised: 01 February 2023*<br>*Published: 25 March 2023*<br>**Keyword:**<br>*Numerical ability, classical random sampling, Likert scale models* | *The purpose of this study was to determine and analyze the contribution of students' learning motivation and numerical ability to the learning outcomes of chemistry count material. This research is quantitative research. The research method was carried out utilizing sampling technique using a proportional classical random sampling technique. Data was collected using multiple-choice tests and Likert scale model questionnaires. Respondents in this study were students of class Ten Science Senior Hight School One Karangdowo total 90 student. Analysis of the data used is a technique of partial correlation analysis and linear regression of two predictors. The results of this study indicate that: there is a significant positive contribution between learning motivation and numerical ability together to the learning outcomes of chemistry in the matter of chemistry. Partially, it shows that there is no significant positive contribution between learning motivation and learning outcomes for the matter of chemistry. Partially, it shows that there is a significant positive contribution between numerical ability on learning outcomes of chemistry calculations. The effective contribution of learning motivation is 0.65% and numerical ability is 8.47%. This shows that during a pandemic, learning motivation contributes less than numerical abilities.* |
| | |

## INTRODUCTION

One way to improve the quality of human life is through improving the quality of education. Improving the quality of education cannot be separated from various efforts to improve and update the curriculum to develop students' potential in maximizing the teaching and learning process, so that intelligent, independent and competitive human beings are produced. As an effort to improve the quality of education, the government has enacted several curricula from the Competency-Based Curriculum (KBK), the Education Unit Level Curriculum (KTSP), the 2013 Curriculum to the "Freedom to Learn" policy. Indicators of improving the quality of education can be seen from the learning outcomes. According to Slameto (2010), factors that influence learning outcomes are classified into two groups, namely internal and external factors. Internal factors include physical, psychological and fatigue factors. While the external factors are family, school, and society.

Since mid-March 2020, Indonesia was declared affected by the Covid-19 virus. The Covid 19 pandemic has greatly impacted all factors of life, one of which is the implementation of education in Indonesia. The government has made several efforts to reduce the spread of Covid-19, one of which has been implemented with an online system or online system since

March 2020. The learning system is carried out without face-to-face meetings, but with a distance learning system. Remote learning lasts until June 2021, with some schools already holding limited face-to-face trials.

Distance learning has been going on for more than a year, this situation causes boredom for most students. This is in line with the author's interviews with several students who went to school for the purpose of returning books. Meanwhile, in the WA group, parents on April 25, 2021 asked when to study face-to-face at school because their children were tired of studying at home. One result of boredom is motivation. At that time, 2 classes of writers managed to interview 15 students. Twelve students stated that they wanted to study face-to-face immediately, 3 other students stated that face-to-face learning was okay, online was also fine. They circled the school environment and stated that they really missed going to school. Besides that, in the group of parents and guardians of students on April 25, 2021, they asked when they could study face-to-face at school because their children were tired of studying at home. One result of boredom is decreased motivation to learn. According to Sardiman (2011), one indicator of motivation is getting bored quickly with routine tasks or things that are mechanical, just over and over again so they are less creative. In line with the research of Cahyani et al (2020), stated that learning motivation in students who took part in online or online learning in the midst of the Covid-19 virus pandemic situation decreased.

According to Hanafiah (2012), "learning motivation is a power (power motivation), driving force (driving force), or a tool for building a strong willingness and desire in students to learn actively, creatively, effectively, innovatively, and fun in order to changes in behavior, both in cognitive, affective, and psychomotor aspects. Meanwhile, according to Uno (2019), "the essence of learning motivation is internal and external encouragement to students who are learning to make changes in behavior, generally with several supporting indicators or elements". Furthermore, according to Asrori (2011), motivation can be interpreted as an impulse that arises in a person, consciously or unconsciously, to perform an action with a specific purpose. Based on some of the opinions above, it can be concluded that learning motivation is internal and external encouragement to students to make changes in behavior, with several supporting indicators. High motivation can increase learning activity and feel optimistic in doing everything that students learn. So that with learning motivation students have the urge to learn more easily. In line with the research of Romadhoni et al (2019), concluded that motivation in learning is very important so that it can affect student learning outcomes. Meanwhile, according to Sumarsih (2017), states that in learning, the level of student persistence is largely determined by the existence of motives and the strength and weakness of learning motivation. Indicators of motivation to learn in this study were diligent in facing assignments, tenacious in facing difficulties, preferring to work independently, having higher concentration power, receiving awards, interesting learning, and a supportive learning environment.

Most students consider chemistry material difficult, abstract, and many calculations so that reasoning is needed to learn. One of the chemistry materials for class X even semester is chemistry calculations. According to Middlecamp and Kean (1985), "Solving problems consisting of numbers (numerical questions) is such an important part in learning chemistry". So that numerical ability will affect the results of learning chemistry material for chemical calculations. In line with this, it was found that the chemistry learning outcomes at Senior High School 1 Karangdowo (SMA) class X MIPA were low. The following presents comparative data on learning outcomes between subjects of mathematics, physics, and chemistry.

**Table 1.** Comparison of Learning Outcomes in Mathematics, Physics, Chemistry

| Mid Semester Deuteronomy Study Results (UTS) | Percentage (%) of subject completeness | | |
|---|---|---|---|
| | Mathematics | Physics | Chemistry |
| Odd class X 2020/2021 | 60 | 55,6 | 55 |
| Even class X 2020/2021 | 63 | 58 | 60 |

Chemistry, physics, and mathematics are subjects related to calculation and reasoning. According to Dariyo (2013), numerical ability is an ability related to how a person performs arithmetical analysis to calculate numbers. Whereas Abed et al (2016), in numerical ability and skill tests we can use speed tests which consist of basic arithmetic, such as addition, parsing and division, number sequences and simple mathematics (percentages, sets and fractions). Based on the opinion above, the researcher can conclude that numerical ability is the ability to count that is needed by someone to complete calculations in the form of numbers by using basic arithmetic functions (arithmetic) which contain reasoning and algebraic skills. The numerical ability tests used in this study are tests of arithmetic, algebra and number series. If it is related to chemical material that has a lot of calculations, then numerical ability is the basis used to study it.

Based on the description above, the writer wants to know whether there is a contribution of learning motivation and numerical abilities to the achievement of students' cognitive learning outcomes, by taking the title "Contribution of Student Learning Motivation and Numerical Ability to Learning Outcomes of Chemical Counts in the Pandemic Period".

**METHOD**

This type of research is correlational quantitative research. The research design used is non-experimental correlational. Examining the relationship of the independent variables with the dependent variable and looking for the effective and relative contribution of the independent variables. The research was conducted at SMA Negeri 1 Karangdowo, from April 2021 to July 2021. The population for this research was all students of class X MIPA SMA Negeri 1 Karangdowo for the 2020/2021 academic year, totaling 180 students. Meanwhile, the sample was taken using a proportional classical random sampling technique, with 50% of the population consisting of 90 students. According to Arikunto (2011), if the subject is less than 100 people it should be taken altogether, if the subject is large or more than 100 people it can be taken 10-15% or 20-25% or more. Based on this opinion, the sample size in this study was taken 50% of the population, in addition, part of the population was used for instrument trials.

There are three research variables to be measured in this study, namely learning motivation (X1), numerical ability (X2), and student chemistry learning outcomes (Y). The data collection used is a multiple-choice test for numerical abilities and learning outcomes, as well as a Likert scale questionnaire to determine learning motivation. The numerical ability test consists of arithmetic, algebra and number series tests. Items about learning outcomes were developed from SK-KD on the concept of chemical calculations. Meanwhile, the items stated on motivation to learn were developed from indicators of being diligent in facing tasks, tenacious in facing difficulties, preferring to work independently, having higher concentration power, receiving awards, interesting learning, and a supportive learning environment. Instrument trials were carried out before being used to collect research data. This is to determine the validity and reliability of the instrument. One class of five classes is used for trials. Analysis of numerical ability test items and learning achievement tests was carried out using the ANOTES version 4.0.9 program. The validity of the learning motivation

questionnaire instrument was analyzed using the Pearson Product moment correlation formula with the help of the SPSS Version 18.0 for windows program. According to Sugiyono (2010), the correlation coefficient is equal to 0.30 or more, so the instrument items are declared valid. On the reliability measurement of both the numerical ability test instrument, the learning achievement test and the learning independence questionnaire and learning motivation were carried out only at one time (one shoot), the instrument was said to be reliable if the Cronbach Alpha value ≥ 0.7.

Data analysis used in this study was descriptive analysis (mean, median, mode, and standard deviation), prerequisite test (normality, linearity, multicollinearity), and hypothesis testing (partial correlation, three predictor linear regression). Partial correlation is used to determine the strength of the relationship between the independent variable and the dependent variable controlled by another independent variable (the relationship between learning motivation and learning outcomes is controlled by numerical ability). Linear regression to determine the contribution of each variable, namely learning motivation and numerical ability. All data were analyzed with the help of the SPSS Version 18.0 for Windows program.

## RESULTS AND DISCUSSION
### Descriptive Analysis
The descriptive data presented includes the mean, mode, median, and standard deviation. Obtained data as follows:

Table.2. Research Variable Descriptive

| Variable | Mean | Median | Modus | Standard Deviation | Max Score | Category |
|---|---|---|---|---|---|---|
| Motivation to learn | 77,93 | 78 | 76 | 9,75 | 52 | Medium |
| Numerical Ability | 15,97 | 16,50 | 18 | 3,24 | 22 | Medium |
| Learning outcomes | 66,22 | 68 | 84 | 12 | 84 | High |

The number of statement items in the learning motivation instrument is 24 items with the maximum value of each statement being 4 and the minimum being 1. The number of questions in the numerical ability instrument is 22 items with the maximum score for each question item being 1 and a minimum of 0. The number of items in the student chemistry learning outcomes instrument is 21 items with the maximum score for each item statement being 4 and a minimum of 0.

### Testing Prerequisites for Analysis Test Data
#### *Normality test*
Based on the calculation of the Kolmogorov-Smirnov method, Asymp.sig.(2-tailed) obtained numerical ability 0.120, learning motivation 0.727, and chemistry learning outcomes 0.084. Asymp.sig.(2-tailed) value > 0.05. So it was concluded that the data on numerical abilities, learning motivation and chemistry learning outcomes of students were normally distributed.

*Linearity test*
Learning motivation variable with chemistry learning outcomes. Based on the calculation, the value of deviation from linearity sig(0.716) > 0.05, Fcount(0.831)<Ftable(1.833). It was concluded that there is a significant linear relationship between the variables of learning motivation and chemistry learning outcomes. Numerical ability variable with chemistry learning outcomes. Based on the calculation, the value of deviation from linearity sig(0.988) > 0.05, Fcount(0.317)<Ftable(1.833). It was concluded that there was a significant linear relationship between the variables of numerical ability and chemistry learning outcomes.

*Multicollinearity Test*
      Based on the calculation results, the Tolerance value for each independent variable of numerical ability is 0.996 and learning motivation is 0.996, meaning that nothing is less than 0.1. The VIF value of each variable for numerical ability is 1.004 and motivation is 1.004, meaning that the VIF value is <10. This means that there is no multicollinearity between the independent variables in the regression model.

*Hypothesis test*
*Multiple Regression Two Predictors.*
      The first hypothesis in this study is that there is a contribution to learning motivation and numerical abilities to the results of learning chemistry material for chemical calculations in class X MIPA SMA Negeri 1 Karangdowo in the 2020/2021 academic year. Based on the results of the multiple regression test it shows that the r value is 0.302, the results of the F test are obtained the F_count value is 4,368 which is greater than the F_table, which is 3.10 at a significant level of 0.05. Means that the variables of learning motivation and numerical abilities together have a significant positive effect on the results of studying chemistry in chemistry calculations for class X SMA Negeri 1 Karangdowo. So, it can be concluded that the higher the learning motivation and numerical ability, the higher the results of learning chemistry material for chemical calculations. Based on the calculations, the $R^2$ value is 0.091, which means that 9.1% of the change in chemistry learning outcomes in the calculation of chemistry can be explained by learning motivation and numerical ability, 90.9% is influenced by other variables. Variables not examined in this study include student independence, teaching methods, learning tools and so on. The effective contribution of learning motivation variables is 0.65% and numerical ability is 8.47%. A student will have good chemistry learning outcomes if supported by numerical abilities and learning motivation together. According to Zamira Hodo (2016), that student motivation is an important component of success in education and in later life. Supported by Rehman (2013), states that student learning outcomes can be improved by motivating them. So, a student must equip himself with numerical abilities and have high motivation in learning.

*Partial Correlation Analysis*
      The second hypothesis in this study is that there is a partial contribution of learning motivation to the results of learning chemistry material for chemical calculations in class X MIPA SMA Negeri 1 Karangdowo in the 2020/2021 academic year. This means that the effect of learning motivation on chemistry learning outcomes is controlled by numerical ability. Based on the calculation of sig.(2-tailed) 0.485 > 0.05 and $r_{Count}$ 0,075 whereas $r_{table}$ 0,207. So that $r_{Count} < r_{table}$ which means Ho is accepted. This means that there is no partial contribution of learning motivation to the results of learning chemistry material for chemical

calculations in class X MIPA SMA Negeri 1 Karangdowo for the 2020/2021 academic year. Based on the conclusion above, learning motivation is internal and external encouragement to students to make changes in behavior, with several supporting indicators. In the learning process, motivation is needed. In connection with the results of the research above, if it is related to the current situation, namely the Covid-19 pandemic. During the Covid-19 pandemic the learning process was carried out from home, so that motivation to learn can be influenced by several factors. Several factors did not support the student learning process during the pandemic, including technological skills mastered by both students and teachers, internet network access connections, instructional media used, students' capacity for online learning, unsupportive environmental conditions at home and others. If these things are not fulfilled optimally, it causes student learning motivation to decrease. Decreased student learning motivation will affect student learning outcomes. This is supported by research from Izzatunisa *et. al.* (2021), which states that during the pandemic students' motivation to learn from home has decreased.

Learning motivation has something to do with learning independence. The effect of the Covid-19 pandemic, which requires studying at home, has reduced the independence of students, even though they are required to study independently at home. Studying at home, most of the assignments, even tests or tests, are not done alone but are done with the help of others. Because they feel they are not being watched indirectly so they lack responsibility. Causing students who are independent and less independent cannot be distinguished from their learning outcomes. Teachers who play a role in schools are less able to provide a maximum learning experience compared to face-to-face learning. So, it does not foster a sense of pleasure and satisfaction in students. The pandemic period, which has been going on for several months, causes students to feel bored, making them less creative in dealing with problems in the learning process. This includes in the process of learning chemistry which is considered difficult, requires reasoning and lots of calculations as well as material for chemical calculations. This is supported by Putriana (2021), stating that for some students the motivation to learn mathematics decreased because they could not understand the subject matter delivered by the teacher which was not optimal and did not vary so that the impact on student achievement decreased. Based on the category of the results of this study, learning motivation is in the medium category (46.7%). When analyzed from the statement items of learning motivation from respondents, it turns out that the four lowest scores are statements of indicators of diligently facing learning tasks, desire to excel in learning, and appreciation in learning. Thus, causing the low contribution of learning motivation to learn outcomes.

The third hypothesis in this study is that there is a partial contribution of numerical ability to the results of studying chemistry in chemical calculation material for class X MIPA students of SMA Negeri 1 Karangdowo in the 2020/2021 academic year. Based on sig.(2-tailed) 0.006 < 0.05 and $r_{Count}$ 0,290 whereas $r_{table}$ 0,207. So that $r_{Count} > r_{table}$ which means Ho is rejected. This means that there is a partial contribution of numerical ability to the results of studying chemistry in chemical calculation material for class X MIPA SMA Negeri 1 Karangdowo in the 2020/2021 academic year. If seen from the value of the relation coefficient, the relationship between numerical ability and learning outcomes is low. The concept of chemical calculation is one of the chemical materials in which there are many calculations, so to master this concept requires reasoning and numeracy skills. For example, in determining the percentage of elements in a molecule as well as the levels of substances in a mixture or solution, the calculation of relative molecular mass uses addition and multiplication operations, mole ratios and volume. This material also involves several units, so care must be taken in applying these units. In this study, numerical ability contributed 8.47% to the results of learning chemistry material for chemical calculations. These results are supported by the opinion of

Fudyartanta (2010), numerical ability tests are very important for predictions in the fields of mathematics, chemistry, physics and can also be used to estimate general learning abilities. The results of this study also support previous research conducted by Gulmah Sugiharti and Bastian J W H (2018), that concluded that there was an effect of numerical ability. high and low numerical ability for chemistry learning outcomes on thermochemical material. Likewise, research conducted by Cahyono et al (2016), there is a significant relationship between numerical ability and learning achievement on hydrolysis material. In Ayodele, O D's research (2014), it shows that when the teacher teaches students' numerical ability is one of the predictors in chemistry learning, student engagement time and numerical ability contribute 63.9% of the total variance (R = 0.639. $p < 0,05$). Meanwhile Fatoke, OA, et al (2013), stated that students with high numerical abilities performed better than students with low numerical abilities.

## CONCLUSION

Based on the results of the study, the following conclusions were drawn: Taken together, there is a significant positive contribution between learning motivation and numerical ability on the results of learning chemistry material for chemistry calculations for class X MIPA SMA Negeri 1 Karangdowo in the 2020/2021 academic year. This shows that the higher the learning motivation and numerical ability, the higher the student learning outcomes. Partially there is no significant positive contribution to learning motivation on the results of studying chemistry in the chemistry calculation material for class X SMA Negeri 1 Karangdowo for the 2020/2021 academic year. There is a significant positive contribution to partial numerical ability towards the results of learning chemistry material for chemical calculations in class X MIPA SMA Negeri 1 Karangdowo for the 2020/2021 academic year. This shows that the increasing numerical ability, the higher the learning outcomes of chemistry calculation material.

## SUGGESTION

Based on the results of the research that the researchers have done, the suggestions given to further researchers are the addition of independent variables such as student independence, and the use of different motivational indicators from this research. Using more samples and data collection during the face-to-face teaching and learning process.

## ACKNOWLEDGMENTS

## REFERENCES

Abed, E. R.-A. (2016). Developing a Numerical Ability Test for Students of Education in Jordan: An Application of Item Response Theory. *International Education Studies, 9(1)*, 161-173.

Arikunto, S. (2011). *Prosedur Penelitian Suatu Pendekatan Praktik.* Jakarta: Rineka Cipta.

Asrori, M. (2011). *Psikologi Pembelajaran.* Bandung: Wacana Prima.

Ayodelle, O. F. (2014). Teacher Instructional Time, Student–Engaged Time and Numerical Ability as Predictors of Student Achievement in Senior Secondary School Chemistry. *Journal of Emerging Trends in Educational Research and Policy Studies (JETERAPS), 5(3)*, 377-380.

Cahyani, A., Listiana, I. D., & Larasati, S. P. (2020). Motivasi Belajar Siswa SMA pada Pembelajaran Daring di Masa Pandemi Covid-19. *Jurnal Pendidikan Islam, Volume 3 No. 01 2020,*, 123-140.

Cahyono, T. D. (2016). Kontribusi Kemampuan Numerik dan Kreativitas terhadap Prestasi Blajar Siswa Pada Materi Pokok Hidrolisis Kelas XI MIA1 dan XI MIA 5 SMA Negeri 2 Karanganyar Tahun Pelajaran 2015/2016. *Jurnal Pendidikan Kimia (JPK), 5( 2)*, 81-88.

Dariyo, A. (2013). *Dasar-Dasar Pedagogi Modern.* Jakarta: PT Indeks.

Fatoke, A.O, Ogunlade, T.O, &Ibidiran,V.O. (2013). The Effects of Problem-Solving Instructional Strategy and Numerical Ability on Students' Learning Outcomes. *The International Journal Of Engineering And Science, 2*(10), 97-102.

Fudyartanta, K. (2010). *Tes Bakat dan Perskalan Kecerdasan.* Yogyakarta: Pustaka Pelajar.

Hanafiah,Nanang & Suhana,Cucu. (2012). *Konsep Strategi Pembelajaran.* Bandung: Refika Aditama.

Hodo, Z. (2016). Students' Motivation Factors: Albania Case. *Journal of Research & Method in Education (IOSR-JRME), 6*(6), 22-29.

Izzatunnisa, L., Suryanda, A., Kholifah, A. S., & Loka, C. (2021). Motivasi Belajar Siswa Selama Pandemi dalam Proses Belajar dari Rumah. *Jurnal Pendidikan, Vol. 9, No. 2, Juli 2021*, 7 - 14.

Middlecamp,Catherin & Kean,Elizabeth. (1985). *Panduan Kimia Dasar.* Jakarta: Gramedia.

Pardimin, S. &. (2017). Upaya Peningkatan Motivasi dan Prestasi Belajar IPA Melalui Penerapan Model Pembelajaran JIGSAW pada Siswa Kelas IX B SMP N 9 Yogyakarta. *Jurnal Penelitian dan Evaluasi Pendidikan.Wiyata Dharma, 5(2)*, 125-134.

Putriana, C., & Noor, N. L. (2021). Pengaruh Pembelajaran Daring terhadap Motivasi dan Prestasi Belajar. *MATH LOCUS: Jurnal Riset dan Inovasi Pendidikan Matematika, Vol. 2, No. 1*, 1~6.

Rehman, Asifa & Haider,Kamal. (2013). The Impact of Motivation on Learning of Secondary School Students in Karachi : An Analytical Study. *Educational Research Internation, 2(2)*, 139-147.

Romadhoni,Evan, Wiharna,Ono, & Mubarak,Ibnu. (2017). Pengaruh Motivasi Belajar Terhadap Hasil Belajar Peserta Didik Pada Mata Pelajaran Gambar Teknik. *Journal of Mechanical Engineering Education, 4(2)*, 228-234.

Sardiman, A. (2011). *Interaksi dan Motivasi belajar mengajar.* Jakarta: Rajawali Grafindo Persada.

Septaria, K. (2022). KEMAMPUAN BERTANYA VERSUS HASIL BELAJAR KOGNITIF MAHASISWA: ANALISIS KORELASI KEMAMPUAN BERTANYA PADA LEVEL MAHASISWA IPA. EDUPROXIMA (Jurnal Ilmiah Pendidikan IPA) Universitas Bhinneka PGRI Tulung Agung, 4(2), 60-71.Slameto. (2010). *Belajar dan Faktor-faktor yang empengaruhinya.* Jakarta: PT. Renika Cipta.

Septaria, K., & Dewanti, B. A. (2021). Implementation of project based learning on student reasoning on COVID-19 disaster mitigation. Prisma Sains: Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram, 9(1), 20-27.

Septaria, K., Sholihin, M., Kholiq, A., Hayati, E., & Maulana, V. I. P. (2021). ANALISIS DAN UPAYA PENINGKATAN PEDAGOGIC & TEACHING SKILL PADA GURU MADRASAH IBTIDAIAH. Prosiding SNasPPM, 6(1), 196-202.

Sugiharti,Gulmah & Habeahan,B J W. (2018). Influence of Learning Model Using Laboratory and Numeric Ability to Student Learning Result on Thermochemical Material. *International Education Studies, 11(5)*, 154-160.

Sugiyono. (2010). *Metode Penelitian Kuantitatif, Kualitatif, dan R & D.* Bandung: Alfabeta.

Uno, H. B. (2019). *Teori Motivasi dan Pengukurannya.* Jakarta: Bumi Aksara.