Jurnal Pendidikan Kimia
Vol. 12 | No. 1 |10 - 19| April | 2020
ISSN: 2085-3653| e-ISSN: 2549-3116
https://jurnal.unimed.ac.id/2012/index.php/jpk
https://jurnal.unimed.ac.id

Improvement of student's learning outcomes and motivation with chemical practicum e-module

Nelius Harefa [1,*] and Novia Fransisca Dewi Silalahi[2]

[1]Department of Chemistry Education, Faculty of Teacher Training and Education, Universitas Kristen Indonesia, Jakarta 13630, Indonesia
[2]Chemistry Teacher of SMA Abdi Siswa Bintaro, Tangerang 15326, Indonesia
*Corresponding author: NH, nelius.harefa@uki.ac.id

DOI: 10.24114/jpkim.v12i1.17708

Received: 31 December 2019 ; Accepted: 06 March 2020

Abstract

The use of modules has an effect on students' motivation and students' learning outcomes. Based on the analysis of learning outcomes data using paired sample t-test SPSS 21 shows that t_{count} (4.872)> t_{table} (2.354) at significance α = 0.05, which means that there are differences in students' learning outcomes taught using chemistry practicum e-modules and practicum modules conventional. Students' learning outcomes by utilizing the chemistry practicum e-modules are higher than students' learning outcomes by utilizing conventional practicum modules. 93.24% of students have very strong motivation to study in the laboratory by utilizing the chemistry practicum e-module while by utilizing conventional practicum modules by 72.98%. Meanwhile, the Pearson Correlation test is 0.613 at significance α = 0.05, which means that there is a strong relationship between learning motivation and student learning outcomes.

Keywords: Chemistry; e-module; learning outcomes; motivation; practicum

1. Introduction

Practicum is one of the important learning methods on science materials, especially chemistry. Chemical learning that is generally associated with natural phenomena and their constituents can be explained carefully through learning with practical methods. Learning with practicum methods can explain abstractive theories into concrete and can be analyzed in more detail. With this method, students can improve their skills and knowledge from cognitive, psychomotor, and affective aspects as well as science process skills (Harefa and Suyanti, 2019).

Efforts to improve the skills and knowledge of students are important to accommodate the times. The demands of skills and knowledge of each era will be different even though in the same concepts and theories. The era of the industrial

revolution 4.0 requires digital integrated skills and knowledge, which means that every learning process including practicum methods should accommodate and be integrated digitally. One important element of practicum learning methods that can be developed to accommodate digitally is the practicum module (Nainggolan et al. 2018) Digital integrated practicum modules are preferred by students compared to conventional practicum modules (Harefa and Purba, 2019). One indicator of increasing knowledge utilizing digital integrated practicum is increasing student learning outcomes.

Digital accommodating practicum methods such as the use of virtual labs can improve student learning outcomes (Rizky and Simorangkir, 2018; Sugiharti et al. 2019) and students' achievements (Panggabean et al. 2019). Practicum accommodating digital-based guided inquiry can improve student learning outcomes and scientific processes (Akbar et al. 2019; Juniar and Fardilah, 2019), student learning motivation (Harefa, 2018), problem solving skills (Abadi and Bahriah, 2016), students' critical thinking skills (Kurniawati et al. 2015; Wardani et al. 2017), and practice the science process (Suryaningsih, 2017). In addition, guided inquiry based practicum can improve students' metacognitive skills (Pratiwi et al. 2019).

Efforts to improve the students' learning outcomes through learning in the laboratory can be effective if coupled with the motivation to learn from students. Learning motivation is very influential on learning achievement as measured by student learning outcomes (Suranto, 2015; Indriani, 2016; Adiputra and Mujiyati, 2017; Arwira et al. 2019; Hanim et al. 2019; Yanuarti and Rosmayanti, 2019). A student who has a low learning motivation will get low learning outcomes (Muhammad, 2016) because students with low motivation generally have low learning interest (Fauziah et al. 2017). In addition, learning motivation also influences critical thinking skills, reading ability, understanding of an object, and scientific literacy (Wahyuni et al. 2018) and students' experience (Silva et al. 2019).

The use of modules (Pebruanti and Munadi, 2015) and learning with practical methods (Wicaksono et al. 2018) can increase student motivation. However, ongoing efforts are needed such as learning based on digital integrated lesson study (Fauziah and Habibah, 2017) because motivation to learn is greatly influenced by students' intrinsic and extrinsic factors (Nyman and Sumpter, 2019) such as places to learn, physical functions, intelligence, facilities and infrastructure , time, study habits, parents, emotional and health, and friend factors (Rohman and Karimah, 2018). A teacher's motivation can even influence the development of his students (Utomo et al. 2019). In general, digital integrated learning methods can improve student learning outcomes (Purba et al. 2018) and student motivation (Purba et al. 2019).

2. Methods

The research was conducted at Abdi Siswa Bintaro Tangerang Tangerang in April-May 2019. The study population was all students of XI IPA who also became a study

sample using saturated sampling techniques totaling 74 students. The sample is divided into two classes namely experimental class 1 (XI IPA 2) and experimental class 2 (XI IPA 1). The study was conducted in a laboratory on buffer solution material, where the experimental class 1 used a digital integrated practicum guide (e-module) and the experimental class 2 used a conventional practicum guide. The students' motivation, students' learning outcomes and their relationship will be analyzed. Research data were processed using SPSS 21 for Windows (Silaban, 2017).

Data on student motivation was collected using a questionnaire that was arranged according to the Linkert scale consisting of 20 statements, each statement was given 5 choice options with the provisions as in Table 1.

Table 1
Questionnaire evaluation categories

Value	Category
1	Strongly disagree
2	Disagree
3	Less agree
4	Agree
5	Strongly agree

Learning outcomes data were collected from students' pretest and posttest scores consisting of 10 essay test questions and 10 multiple choice questions designed as shown in Table 2. The relationship of student's motivation and learning outcomes refers to the Pearson correlation value, with provisions such as Table 3.

Table 2
Study Design of Students' Learning Outcomes

	Pretest	Treatment	Posttest
Experiment 1	D1	X	D2
Experiment 2	G1	Y	G2

Note: D1 = Students' pretest average score of experiment 1 class; D2 = Students' posttest average score of experiment 1 class; G1 = Students' pretest average score of experiment 2 class; G2 = Students' posttest average score of experiment 2 class

Table 3
Pearson Correlation Value Category

Pearson Correlation Value	Category
0.21 – 0.40	Less Correlation
0.41 – 0.60	Medium Correlation
0.61 – 0.80	Strong Correlation
0.81 – 1.00	Perfect Correlation

3. Results and Discussion

This research was conducted on learning in the laboratory with buffer solution material which quasi experimental design. The class is divided into two namely the

experimental class 1 and the experimental class 2. The experimental class 1 is taught using e-module chemistry practicum and the experimental class 2 is taught using a conventional practicum module. This study produces data on student motivation, student learning outcomes, and the relationship of motivation with student learning outcomes. The results of data analysis on student motivation are shown in Fig 1.

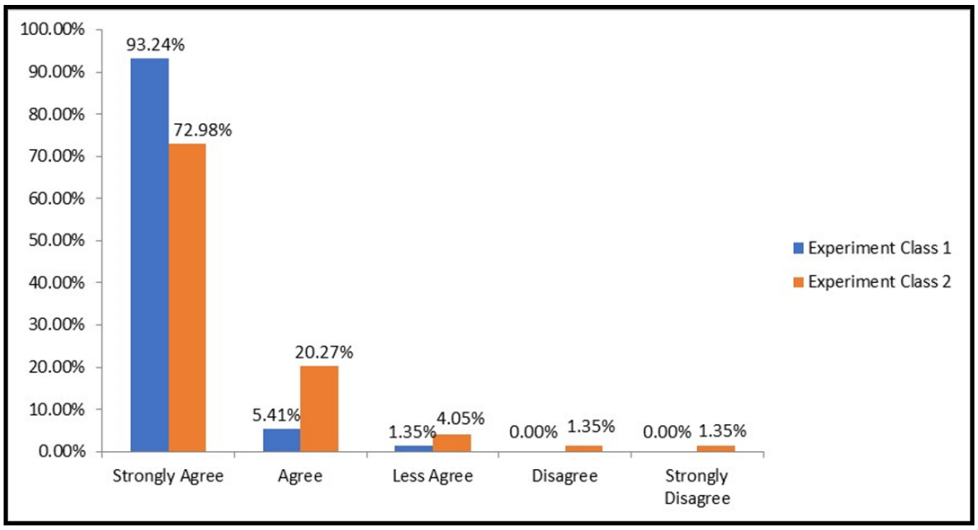

Fig 1. The differences of students' motivation

Learning outcomes are a comparison between students' pretest scores and posttest scores after the whole series of learning is complete. To see the difference in the improvement in student learning outcomes of experimental class 1 and experimental class 2, the learning outcomes data were analyzed using paired sample t-test SPSS 21 for Windows, it is shown in Table 4. Analysis of differences in learning outcomes is important because it provides a picture of the success of the learning process as incorrect one indicator of learning success.

The relationship between motivation and student learning outcomes from the two experimental classes was analyzed with Pearson Correlation SPSS 21 for Windows shown in Table 5. The analysis is important because it can give an idea of the relationship between motivation and student learning outcomes in the use of chemistry e-module practicum. In addition, the analysis of the relationship of motivation with learning outcomes can provide a general picture of the relationship between affective aspects and cognitive aspects of students.

Table 4
The students' learning outcomes differences

Class		t_{count}	t_{table}
Experiment 1	**Experiment 2**		
X = 86.91	X = 80.06		
SD = 9.32	SD = 7.01	4.872	2.354
S^2 = 62.76	S^2 = 34.25		

Table 5
The correlation between students' learning outcomes and motivation

		Learning outcomes	Motivation
Learning outcomes	Pearson Correlation	1	.613**
	Sig. (2-tailed)		.000
	N	72	72
Motivation	Pearson Correlation	.613**	1
	Sig. (2-tailed)	.000	
	N	72	72

This research was conducted in a laboratory on buffer solution material. Variables analyzed include: students 'motivation, students' learning outcomes, and the correlation between student's motivation and student's learning outcomes. These variables are compared with implementing the chemistry practicum e-module and conventional chemistry practicum modules.

3.1 Students' motivation

Learning motivation is very important to be developed and instilled in students so that students have a desire to learn with their own awareness. Learning motivation is closely related to students' achievement (Indriani, 2016; Yanuarti & Rosmayanti, 2019), students who have good motivation for learning will have good learning achievements too (Suranto, 2015; Adiputra & Mujiyati, 2017). One indicator of learning achievement is students' learning outcomes. Students with good learning outcomes generally have high motivation to learn (Arwira et al. 2019; Hanim et al. 2019).

Motivation directly affects the ability to think critically, the ability to read, the understanding of an object, and scientific literacy (Wahyuni et al. 2018). Students who have good critical abilities will influence the student's experimentation process, a good experimental process will affect the improvement of learning outcomes. Students who have good motivation in learning will have good reading skills, the reading ability will make it easier for a student to understand an object being analyzed. The ability to understand an object will increase scientific literacy so students have a broad understanding of a science object. In addition, students who have good motivation will have a good interest in learning (Fauziah et al. 2017).

Based on the results of the research shown in Fig 1., it appears that 93.24% of students are highly motivated to learn in the laboratory by utilizing chemistry e-module practicum compared to 72.98% with the use of conventional practicum modules. Meanwhile, with the use of chemistry practicum e-module, there were no students who were very unmotivated to do the learning process in the laboratory, whereas 1.35% of students felt very unmotivated to do the learning process in the laboratory by utilizing conventional practicum modules. From the analysis of these data shows that the use of modules affects student motivation. By utilizing the

chemistry practicum e-module, students' learning motivation increases compared to conventional practicum modules.

Learning using modules can increase student learning motivation (Pebruanti & Munadi, 2015), specifically integrated lesson study learning (Fauziah & Habibah, 2017). However, digital integrated modules are more effective in increasing student motivation (Wicaksono et al. 2018; Purba et al. 2019) while increasing students interest in learning (Harefa & Purba, 2019).

3.2 Students' learning outcomes

Digital integrated learning is very suitable for learning in the era of the industrial revolution 4.0, digital integrated learning is more effective in improving student learning outcomes than conventional learning (Harefa et al. 2019). Likewise learning in the laboratory, it is important to do variations especially models, media, and digital integrated learning strategies to help students gain meaningful learning and good learning outcomes (Akbar et al. 2019; Nainggolan et al. 2018). Practicum by utilizing virtual media based on problem based learning can improve student learning outcomes compared to conventional based learning (Rizky & Simorangkir, 2018).

Learning in digital integrated laboratories can improve students 'achievement (Panggabean et al. 2019; Muchtar et al. 2020) and students' metacognitive skills (Pratiwi et al. 2019). Meanwhile, learning with guided inquiry integrated practicum can improve science process skills and student learning outcomes (Juniar & Fardilah, 2019). In general, learning in digital integrated laboratories such as virtual media can improve student learning outcomes (Sugiharti et al. 2019).

Based on the analysis of research data shown in Table 4, it shows that there are differences in student learning outcomes that are learned by utilizing integrated digital practicum modules and conventional practicum modules in learning in the laboratory. It was based on the results of the analysis using Paired sample SPSS 21 t-test where t_{count} (4.872)> t_{table} (2.354) at significance α = 0.05. Interpretation of research data shows that student learning outcomes taught using the chemistry practicum e-module are higher than student learning outcomes learned using conventional practicum modules.

3.3 The correlation between students' motivation and learning outcomes

With practicum methods, students' learning motivation and science process skills will be stimulated to become better (Harefa, 2018). The science process skills will influence students 'scientific processes and learning outcomes (Harefa & Suyanti, 2019) as well as students' ability to experiment (Silva et al. 2019). Therefore, it is important to stimulate student motivation so that learning outcomes can increase (Muhammad, 2016).

Based on the analysis of research data shown in Table 5, through the Pearson Correlation value of 0.613 at significance α = 0.05 shows that there is a relationship

between learning motivation with student learning outcomes in the category of strong correlation. This means that the use of chemistry practicum e-module can increase student motivation while improving learning outcomes. Through learning in the laboratory by utilizing the chemistry practicum e-module, student motivation can be synergized closely to improve learning outcomes.

4. Conclusion

Digital integrated practicum modules affect student motivation and learning outcomes. Analysis of research data shows that 93.24% of students are highly motivated to do practicum in the laboratory by utilizing chemistry e-module practicum. Meanwhile, 72.98% of students are very motivated to do practicum by utilizing conventional practicum modules. In terms of learning outcomes, students who are taught by utilizing chemistry e-module practicum have higher learning outcomes than students who use conventional practicum modules. From this analysis shows that the use of chemistry e-module practicum plays an important role to stimulate students' learning motivation as well as learning outcomes.

Learning motivation is very important to be developed because it can affect cognitive aspects, psychomotor aspects, and other affective aspects. Analysis of research data shows that there is a strong relationship between motivation and student learning outcomes by utilizing chemistry e-module practicum, which is shown by Pearson Correlation Value (0.613). Thus, learning motivation can stimulate students to learn optimally and is reflected in an increase in learning outcomes.

Acknowledgments

Thank you to the principal, chemistry teacher, administrative staff, and students of SMA Abdi Siswa Bintaro, Tangerang for their willingness and cooperation in research. Acknowledgments were also conveyed to the Universitas Kristen Indonesia for its positive contribution in supporting this research.

References

Abadi, S. M., & Bahriah, E. S. (2016). Motivasi belajar siswa pada materi ikatan kimia melalui metode praktikum. *EduChemia (Jurnal Kimia dan Pendidikan)*, *1*(1), 86-97, **doi: 10.30870/educhemia.v1i1.442**

Adiputra, S., & Mujiyati, M. (2017). Motivasi dan prestasi belajar siswa di Indonesia: Kajian meta-analisis. *Konselor*, *6*(4), 150-157, **doi: 10.24036/02017648171-0-00**

Akbar, J. S., Dasna, I. W., & Wonorahardjo, S. (2019). The effect of guided inquiry-based practicum learning and prior knowledge on learning outcomes and science process skills of high school students on solubility and solubility products. *Jurnal Pendidikan Sains*, *7*(3), **doi: 10.17977/jps.v7i3.12521**

Arwira, T. M., Suyanti, R. D., & Saragi, D. (2019). The effect of problem based on learning models using macromedia flash and motivation against student learning outcomes on

environmental pollution materials. *Budapest International Research and Critics Institute (BIRCI-Journal): Humanities and Social Sciences*, *2*(4), 326-333, **doi: 10.33258/birci.v2i4.623**

Fauziah, A., Rosnaningsih, A., & Azhar, S. (2017). Hubungan antara motivasi belajar dengan minat belajar siswa kelas IV SDN Poris Gaga 05 kota Tangerang. *Jurnal JPSD*, *4*(1), **doi: 10.26555/jpsd**

Fauziah, I. S., & Habibah, S. (2017). Upaya meningkatkan motivasi belajar siswa melalui lesson study di kelas V SD Negeri Lampagen Aceh Besar. *Jurnal Ilmiah Pendidikan Guru Sekolah Dasar, 2*(1), 30-38.

Hanim, F., Suyanti, R. D., & Harahap, F. (2017). The effect of students' worksheet based on skill of science and motivation process toward learning outcomes at grade 4 SD Negeri 164330 Tebing Tinggi. *IOSR Journal of Research & Method in Education (IOSR-JRME)*, *7*(5), 57-61.

Harefa, N. (2018). Hubungan motivasi belajar terhadap keterampilan pemecahan masalah siswa pada metode praktikum. *Jurnal Selaras: Kajian Bimbingan dan Konseling serta Psikologi Pendidikan*, *1*(1), 28-38.

Harefa, N., & Purba, L. S. L. (2019). The development of chemistry practicum e-module based on simple-practice. *Jurnal Pendidikan Kimia*, *11*(3), 107-115, **doi: 10.24114/jpkim.v11i3.15739**

Harefa, N., Silalahi, N. F. D., Sormin, E., Purba, L. S. L., & Sumiyati, S. (2019). The difference of students' learning outcomes with project based learning using handout and sway Microsoft 365. *Jurnal Pendidikan Kimia*, *11*(2), 24-30, **doi: 10.24114/jpkim.v11i2.14459**

Harefa, N., & Suyanti, R. D. (2019). Science generic skills of 'chemistry'? prospective teachers: A study on collaborative learning using Exe-media. *Journal of Physics: Conference Series*, **1397** 012032, **doi: 10.1088/1742-6596/1397/1/012032**

Indriani, A. (2016). Pengaruh motivasi belajar siswa kelas V terhadap prestasi belajar matematika di SD Negeri Bejirejo Kecamatan Kunduran Kabupaten Blora. *JIPM (Jurnal Ilmiah Pendidikan Matematika)*, *4*(2), 134-139, **doi: 10.25273/jipm.v4i2.848**

Juniar, A., & Fardilah, R. D. (2019). The difference of students' learning outcomes and science process skill which taught by guided inquiry and direct instruction with practicum integrated. *Jurnal Pendidikan Kimia*, *11*(1), 8-13, **doi: 10.24114/jpkim.v11i1.13035**

Kurniawati, L., Akbar, R. O., & Misri, M. A. (2015). Pengaruh penerapan metode pembelajaran praktikum terhadap keterampilan berpikir kritis matematika siswa kelas VII SMP N 3 sumber kabupaten Cirebon. *EduMa*, *4*(2), 62-74.

Muchtar, Z., Rosalia, A. V. A., & Silaban, S. (2019). Implementation of dubido based on contextual in improving students achievement on rate reaction. *Journal of Physics: Conference Series*, **1462** 012053, **doi: 10.1088/1742-6596/1462/1/012053**

Muhammad, M. (2017). Pengaruh motivasi dalam pembelajaran. *Lantanida Journal*, *4*(2), 87-97, **doi: 10.22373/lj.v4i2.1881**

Nainggolan, B., Pinem, I. S. A., & Hutabarat, W. (2018). Development of chemical practice guides class xi project based to improve student's chemical learning outcomes on acid base materials. *Jurnal Pendidikan Kimia*, *10*(2), 393-396, **doi: 10.24114/jpkim.v10i2.11018**

Nyman, M., & Sumpter, L. (2019). The issue of 'proudliness': Primary students' motivation towards mathematics. *LUMAT: International Journal on Math, Science and Technology Education*, *7*(2), 80-96, **doi: 10.31129/LUMAT.7.2.331**

Panggabean, F. T. M., Silaban, S., & Simorangkir, M. (2019). Implementation of virtual lab media using problem based learning models to increase students learning achievement based STIFI and learning style test. *AISTSSE* 2018, **doi: 10.4108/eai.18-10-2018.2287391**

Pratiwi, I., Ismanisa, I., & Nugraha, A. W. (2019). Development of guided inquiry based modules to improve learning outcomes and metacognition skills of student. *Jurnal Pendidikan Kimia*, *11*(2), 49-56, **doi: 10.24114/jpkim.v11i2.14462**

Pebruanti, L., & Munadi, S. (2015). Peningkatan motivasi dan hasil belajar pada mata pelajaran pemograman dasar menggunakan modul di SMKN 2 Sumbawa. *Jurnal Pendidikan Vokasi*, 5(3), 365-376, **doi: 10.21831/jpv.v5i3.6490**

Purba, D. N., Damanik, M., Silaban, S., & Simatupang, L. (2018). The difference of student's activities and learning outcome with problem based learning using macromedia flash and handout. *Jurnal Pendidikan Kimia*, 10, 403-408, **doi: 10.24114/jpkim.v10i3.12704**

Purba, L. S. L., Sormin, E., Harefa, N., & Sumiyati, S. (2019). Effectiveness of use of online games kahoot! chemical to improve student learning motivation. *Jurnal Pendidikan Kimia*, *11*(2), 57-66, **doi: 10.24114/jpkim.v11i2.14463**

Rizki, Y., & Simorangkir, M. (2018). The influence of virtual chemistry laboratory media on students' understanding of submicroscopic level and student activity grade XI. In *3rd Annual International Seminar on Transformative Education and Educational Leadership (AISTEEL 2018)*. Atlantis Press, **doi: 10.2991/aisteel-18.2018.112**

Rohman, A. A., & Karimah, S. (2018). Faktor-faktor yang mempengaruhi rendahnya motivasi belajar siswa kelas XI. *At-Taqaddum*, *10*(1), 95-108, **doi: 10.21580/at.v10i1.2651**

Silaban, S. (2017). Dasar-dasar pendidikan matematika dan ilmu pengetahuan alam. Medan: Harapan Cerdas Publisher.

Silva, J. O., Wiese, I., German, D. M., Treude, C., Gerosa, M. A., & Steinmacher, I. (2019). Google summer of code: Student motivations and contributions. *Journal of Systems and Software*, 110487, **doi: 10.1016/j.jss.2019.11048**

Sugiharti, G., Hamid, A., & Mukhtar, M. (2019). The implementation of learning model and virtual lab toward learning outcome of chemistry education. *Jurnal Pendidikan Kimia*, *11*(3), 79-86, **doi: 10.24114/jpkim.v11i3.15734**

Suranto, S. (2015). Pengaruh motivasi, suasana lingkungan dan sarana prasarana belajar terhadap prestasi belajar siswa (studi kasus pada sma khusus putri sma islam diponegoro surakarta). *Jurnal Pendidikan Ilmu Sosial*, 25(2), 11-19, **doi: 10.2317/jpis.v25i2.1532**

Suryaningsih, Y. (2017). Pembelajaran berbasis praktikum sebagai sarana siswa untuk berlatih menerapkan keterampilan proses sains dalam materi biologi. *Bio Educatio*, 2(2), 49-57.

Utomo, H. B., Suminar, D. R., & Hamidah, H. (2019). Capturing teaching motivation of teacher in the disadvantaged areas. *Jurnal Cakrawala Pendidikan*, *38*(3), **doi: 10.21831/cp.v38i3.26411**

Wahyuni, S., Miarsyah, M., & Adisyahputra, A. (2018). Achievement motivation, critical thinking skills, and reading comprehension correlation with scientific literacy among senior high school students. *Jurnal Pendidikan Sains*, 6(2), 30-37, **doi: 10.17977/jps.v6i2.11680**

Wardani, S., Lindawati, L., & Kusuma, S. B. W. (2017). The development of inquiry by using android-system-based chemistry board game to improve learning outcome and critical thinking ability. *Jurnal Pendidikan IPA Indonesia*, 6(2), 196-205, **doi: 10.15294/jpii.v6i2.8360**

Wicaksono, A. T., Subandi, S., & Marfu'ah, S. (2018). Comparing lab-work learning assisted with vee diagram and lecturing-demonstration in improving students learning motivation and outcomes on buffer solution topic. *Jurnal Pendidikan Sains*, 6(1), 6, **doi: 10.17977/jps.v6i1.11533**

Yanuarti, H., & Rosmayanti, D. (2019). The relationship between students'motivation and their learning achievement. *PROJECT (Professional Journal of English Education)*, *1*(6), **doi: 10.22460/project.v1i6.p783-788**