Efficacy and potential of physics education students in mathematical physics subject

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Abstract. The concept of self-efficacy relates to people's judgment of their (potential) ability to act in certain situations, one of which is academically related. The purpose of this study is to determine self-efficacy and potential students during the lecture for the subject of mathematics-physics. The type of his research is ex-post facto that is causality, with a sample of 20 students of Physics Education from UIN Sunan Gunung Djati Bandung, the academic year 2017/2018. The instruments used consisted of self-efficacy questionnaires and potential tests of written examinations. Data were analyzed using descriptive statistics. The results show the profile of the efficacy and potential of physics education students to the mathematical physics subject included in the medium category.

1. Introduction

Universities according to the Law of the Republic of Indonesia number 20 of 2003 on the national education system, can take the form of the academy, polytechnic, high school, institute, or university. One of the existing courses in some universities or educational and educational institutes is physics education. Physics education is major in college that will produce a professional educator. The course in this department is not a course that can be viewed easily. One difficult subject is mathematical physics.

The subject of mathematical physics can be said to be a merger of basic physics with the calculus (mathematics) in which both of these subjects have been taken during high school or equivalent. When viewed from the portion of the subject hours for high school and equivalent, then the students who come from science majors should have more experience than other majors related subjects of mathematics and physics. In reality, these two subjects can be categorized as difficult, that the subject of physics is one of the subjects often called difficult by learners [1]. Likewise with math subjects, as the result of research conducted that mathematics is one of the least motivated subjects to be followed by learners because these subjects are difficult [2]. So it can be concluded math and physics course is difficult, especially if the two things are combined. It is natural that mathematical physics is a high degree of difficulty for students who support it.

The subject of mathematical physics is a course that demands students to have the ability to formulate the problem of physics into mathematical statements and resolved analytically [3]. It cannot be denied that the mathematical physics subject is a frightening spectre for most stratum students of a physics education course. The lack of confidence in these subjects resulted in the low motivation of student learning in this mathematical physics course. Should, in following a course, students must have a high motivation both internal motivation and external motivation. This is because the high motivation will lead to achievements that are high [4].

Self-motivation is closely linked to self-efficacy or self-confidence. The individual motivation is high cognitively due to high self-efficacy, which is perceived, especially if the goal to be achieved more
directed [5]. According to Bandura there are three components that provide an impetus for the formation of self-efficacy, namely outcome expectancy is the expectation of possible outcomes of behaviour, efficacy expectancy which is influenced by the perception of a person on the ability of performance related to the results, and outcome value is the value of meaningfulness of the results obtained someone [6].

In addition to self-motivation, efficacy also plays a role to expend all the potentials themselves. The self-efficacy plays an important role in everyday life, the potential of one's self can be used optimally if self-efficacy supports it [7]. Basically, not a few people who cannot find the strengths themselves, even just recognize it inside them. This is certainly detrimental, given the potential of self will really help a person to be able to develop with maximum and achieve many things in his life. When a person is incapable of finding his or her potential, then it is likely that the person will only accomplish that same achievement throughout his life. The person will not be able to grow maximally and reach the best point in his life, or may even be worse than the condition. This is the reason why it is so important to recognize and develop that potential as much as possible, in order to grow and succeed in many ways.

So based on the description above, the authors conducted a study related to one of the existing courses in the college of mathematical physics that is controlled by students majoring in physics education UIN Sunan Gunung Djati Bandung. From the learning outcomes during one semester, this can be seen how the efficacy and potential of each student and whether there is a link between efficacy with self-potential of students who take this course.

2. Methods
The method used in this research is ex-post facto. Ex post facto is a study where a series of independent variables has occurred at the time the researcher started observations for the dependent variable [8]. The nature of this study is the absence of control over the variables, in which variables are seen as they are. This means that researchers who use this method, do not start the process from the beginning but will immediately take the results [9].

The data in this research is efficacy score and score of student potency in physics mathematics subject taken from 20 students of physics education program UIN Sunan Gunung Djati Bandung who has to take the subject. The student's efficacy score on mathematical physics is taken from a questionnaire containing 50 statement points with the following grid.

| No. | Indicators         | Item (+)   | Item (-)   | Point |
|-----|--------------------|------------|------------|-------|
| 1   | Sense of interest  | 10, 18, 26, 39, 49 | 7, 17, 23, 40, 46 | 10    |
| 2   | Feeling happy      | 1, 4, 25, 41, 42 | 15, 22, 28, 44, 47 | 10    |
| 3   | Attention          | 9, 11, 12, 20, 31 | 5, 8, 16, 24, 32 | 10    |
| 4   | Participation      | 14, 19, 27, 30, 50 | 6, 29, 35, 34, 38, 45 | 10    |
| 5   | Desire / Awareness | 3, 13, 21, 37, 48 | 2, 33, 34, 38, 45 | 10    |

| Amount | 50 |

while for the student's potential score on mathematical physics is taken from the value of midterm exam and the value of student assignment in the mathematical physics course.

After the data obtained, then analyzed the data. Analysis of existing data using descriptive statistics in the form of tabulation so easily understood and interpreted [10]. The analysis is done with the following steps: give a score on each questionnaire that has been filled also on the test sheet and each respondent's tasks, calculate the score, convert the score on a scale of 0-10 value and subsequently categorized. The potential category of students on mathematical physics as in Table 2 [11].

| No | Category | Criteria       |
|----|----------|----------------|
| 1  | High     | $8.00 \leq X \leq 10.00$ |
| 2  | Medium   | $6.00 \leq X < 8.00$   |
| 3  | Low      | $4.00 \leq X < 6.00$   |
While the efficacy category is created by first determining the standard deviation of the existing values, then determining the interval width to change the interval value to a range of 0-10 and finally determine the classification boundary values. The following table of categories of student motivation on mathematical physics can be seen in Table 3.

| No | Category | Criteria          |
|----|----------|-------------------|
| 1  | Highest  | ≥8.50             |
| 2  | High     | 7.00 ≤ X < 8.50   |
| 3  | Medium   | 5.50 ≤ X < 7.00   |
| 4  | Low      | 4.00 ≤ X < 5.50   |
| 5  | Lowest   | <4.00             |

3. Results and Discussion

Based on the data, it was found that the efficacy of physics education program students on mathematical physics subject in the medium category, meanwhile the average result of motivation from all respondents was 6.96 on scale 0-10 (medium category). Figure 1 below shows the efficacy profiles of each respondent to mathematical physics.

![Figure 1. Efficacy profile of student against mathematical physics subject](image)

From the Figure 1 seen only a small percentage of students who have medium efficacy, most have a high efficacy against mathematical physics. The following recapitulation of student efficacy categorization on mathematical physics can be seen in the following in Table 4.

| No | Category | Amount |
|----|----------|--------|
| 1  | Highest  | 0      |
| 2  | High     | 12     |
| 3  | Medium   | 8      |
| 4  | Low      | 0      |
| 5  | Lowest   | 0      |

From the table shows that physics education student of UIN Sunan Gunung Djati Bandung has a high efficacy to the mathematical physics subject, from 20 respondents 12 people have high efficacy and 8 others have medium efficacy to mathematical physics. The high efficacy of mathematical physics can be caused by the high desire of students to get high learning results as well. In line with the results of research that high learning results are supported by high learning motivation as well [12]. In addition, conveyed that students who have high motivation can produce high average learning outcomes as well [13]. Figure 2 below shows the average score of each indicator in the questionnaire.
Figure 2. Average results of questionnaire on each indicator

From that Figure 2 shows each indicator is medium to high category. The attention indicator (7.26) and participation (7.31) are high categories while the other aspects of interest (6.94), feeling of pleasure (6.63), and desire (6.61) are a medium category. A seen indicator of desire is an indicator of efficacy with the lowest score, this indicates that the desire and feelings of student pleasure are lowest compared with participation, attention, and interest in mathematical physics. Indeed both indicators are classified but the score of the two indicators is the lowest that resulted in passive students tendency in this mathematical physics mathematics. Mathematics-physics is dominated by lecturers while students tend to be inactive both in terms of questioning activities and expressing opinions [14].

Each indicator in the questionnaire has a role to motivate/efficacy students. For example, interest or desire to learn mathematical physics will affect the motivation to learn mathematical physics itself. In line with this, the motivation of students to be active in the classroom can be stimulated by students' interest in active activity [15]. The potential of physics education students on mathematical physics is still moderate with an average of 7.45 (medium category). The potential of each respondent can be seen in the following Figure 3.

Figure 3. Profile of student potential on mathematical physics student

From the Figure 3, it can be seen that each respondent has potential with the medium category of mathematics physics subject but there is one respondent that has high potential. The lack of high potential students in the mathematical physics course can be due to the lack of potential for the calculus and basic physics of the students.

4. Conclusion

Based on the results of this study, obtained the results of the efficacy profile and the potential of physics education students in UIN Sunan Gunung Djati Bandung. The efficacy of the mathematical physics subject is in the medium category with an average score of 6.96 on a scale of 0-10. While the potential of mathematical physics was classified with the average score of 7.45 on the scale of 0-10.
References

[1] G. B. Samudra, I. W. Suastra, and K. Suma, “Permasalahan-Permasalahan yang Dihadapi Siswa SMA di Kota Singaraja dalam Mempelajari Fisika,” *E-Journal Program Pascasarjana Universitas Pendidikan Ganesha*, vol. 4, no. 1, pp. 1–7, 2014.

[2] K. T. Aritonang, “Minat dan Motivasi dalam Meningkatkan Hasil Belajar Siswa,” *Jurnal Pendidikan Penabur*, vol. 7, no. 10, pp. 11–21, 2008.

[3] S. Desy Fatmaryanti, “Peningkatan Aktivitas dan Hasil Belajar Fisika Matematika I dengan Metode Brainstorming dan Tutor Teman Sebaya,” *JRKPF UAD*, vol. 1, no. 1, pp. 19–21, 2014.

[4] Sufirmansyah, “Pengaruh Efikasi Diri terhadap Prestasi Belajar Mahasiswa Pascasarjana Prodi PAI STAIN Kediri dengan Motivasi Sebagai Variabel Intervening,” *Didaktika Religia*, vol. 3, no. 2, pp. 133–156, 2015.

[5] S. Azwar, “Efikasi-Diri dan Prestasi Belajar Statistika pada Mahasiswa,” *Jurnal Psikologi*, vol. 23, no. 1, pp. 33–40, 1996.

[6] M. Ni’mah Suseno, “Pengaruh Pelatihan Komunikasi Interpersonal terhadap Efikasi Diri Sebagai Pelatih pada Mahasiswa,” *Jurnal Intervensi Psikologi*, vol. 1, no. 1, pp. 93–106, 2009.

[7] I. M. Rustika, “Efikasi Diri: Tinjauan Teori Albert Bandura,” *Buletin Psikologi*, vol. 20, no. 1–2, pp. 18–25, 2016.

[8] Sukardi, *Metodologi Penelitian Pendidikan*. Yogyakarta: Bumi Aksara, 2003.

[9] S. Arikunto, *Prosedur Penelitian, Suatu Pendekatan Praktek*. Yogyakarta: Rineka Cipta, 2002.

[10] Sugiyono, *Metode Penelitian Kuantitatif, Kualitatif dan R&D*. Bandung: CV. Alfabeta, 2013.

[11] F. Nur Hasanah and B. Subali, “Kemampuan Berpikir Divergen Keterampilan Proses Sains Siswa SMA Negeri Kulon Progo Berdasarkan Potensi Siswa,” *Jurnal Pendidikan Biologi*, vol. 5, no. 5, pp. 51–58, 2016.

[12] G. Hamdu and L. Agustina, “Pengaruh Motivasi Belajar Siswa terhadap Prestasi Belajar IPA di Sekolah Dasar (Studi Kasus terhadap Siswa Kelas IV SDN Tarumanagara Kecamatan Tawang Kota Tasikmalaya),” *Jurnal Penelitian Pendidikan*, vol. 12, no. 1, pp. 90–96, 2011.

[13] J. Handhika, “Efektivitas Media Pembelajaran IM3 Ditinjau dari Motivasi Belajar,” *Jurnal Pendidikan IPA Indonesia*, vol. 1, no. 2, pp. 109–114, 2012.

[14] S. D. Fatmaryanti, “Peningkatan Aktivitas dan Hasil Belajar Fisika Matematika 1 dengan Metode Brainstorming dan Tutor Teman Sebaya,” *Jurnal Riset dan Kajian. Pendidikan Fisika*, vol. 1, no. 1, pp. 19–21, 2014.

[15] D. M. Tyasning, Haryono, and N. D. Nurhayati, “Penerapan Model Pembelajaran TGT (Teams Games Tournaments) Dilengkapi LKS untuk Meningkatkan Aktivitas dan Hasil Belajar Materi Minya Bumi pada Kelas X-4 SMA Batik 1 Surakarta tahun Pelajaran 2011/2012,” *Jurnal Pendidikan Kimia*, vol. 1, no. 1, pp. 26–33, 2012.