Fitness and Learning Performance among Polytechnic Students

A. R. Shadiqin¹*, Endang Sri Dewi², and Sri Rahayu²

¹Universitas Lambung Mangkurat, Banjarbaru, Indonesia *
²Poltekkes Kemenkes Malang, Malang, Indonesia

ar.shadiqin@yahoo.com

Abstract. Learning performance could be affected by several factors, one of it is body fitness. This paper aims to describe the fitness and learning performance among polytechnic students. It is based on the findings and results of observing the second-year polytechnic students. Twenty-five girls do series of fitness test and competency test. As a result, students with lower BMI have higher VO2Max since they can run faster than their competitors. Students with higher VO2Max have better learning outcome than other respondents.

1. Introduction

Students learning performance is influenced by various factors. Considerable research has examined those influential factors [1]–[3]. It is proved that students’ satisfaction and motivation as well as their teacher performance has significant influence to students learning performance [4], [5]. While students feel happy their motivation could be increased in line with their learning performance. For example, sport based engineering course is beneficial and delightful for students learning process [6]. Furthermore, when students learn from smart teacher their possibility to become smarter is also increasing. There are still others influential factors that might boost the pupils’ performance, especially engineering and polytechnic students.

The characteristics of engineering or polytechnic students are different with general students. They must master both theoretical knowledge and fundamental work skills [7]–[9]. Since they expected to become skillful workers, they should improve their ability by doing practical actions. They should be able to operate several machines of woods or metal working, medical treatments, and another special-purpose machinery. That hands-on activity required absolutely splendid health conditions.

There is some global research on students’ physically and mentally health and its impact to learning performance. The first research discusses on Korean teenagers’ health behaviors and the their academic performance [10]. They suggest teenagers conduct systematic diet, reducing smoking and alcohol drinking, and physical activity for refining their academic achievement. One study of scores the students health responsibility, nutritional habits, spiritual growth, interpersonal relations, or stress-management [11]. The result offers an understanding that the health-related issues of young universities students has implications for the health of youngsters in the wider community.

Another research focused on the evaluation of cardiorespiratory fitness (CRF) and the body mass index (BMI) of Brazilian schoolchildren [12]. They found that children with higher BMI and CRF may possess lower maximal oxygen uptake (VO2max) as indicator of aerobic fitness [13]–[15]. In other words, they consume less oxygen than ones with low BMI. Another research focused on
examining the relationship between part time working, mental and physical health and academic performance [16]. This research found that working more hours tend to decrease the student academic performance.

The physical fitness and academic achievement relationship has received much courtesy due to the increasing prevalence of unfit and overweight students [17]. However, none of researches discuss the fitness and performance among polytechnic students.

This paper discovers the fitness and learning performance among polytechnic students. The research method, result and discussion will be discussed in the following subsections.

2. Method

The research is conducted in a public polytechnic in Malang. Two academics with physical education experience carried out the tests and measurements. The number population is 25 female students, who attend the classes regularly. This study uses uniform age, gender, attendance and treatments to avoid data discrepancy.

The research is divided into following observed tests. The first test is the fitness test [17]–[19]. Before performing the test, every respondent’s weight and height. Their body composition is then presented by Body Mass Index (BMI). Afterwards, they have to run three times a week with distance of 1.6 kms. The running time is recorded and used to calculate VO2Max together with other parameters such as heart rate and weight. The VO2Max is measured using the Rockport Fitness Walking Test [20], [21].

The second test is competency test [22], [23]. After one week running treatment, the students must do their written vocational competency test. Students have to reach 80 to pass the test. Otherwise, they have to do remedial test until they succeed. The frequency of each student test is also recorded.

Finally, descriptive statistics is used to describe the finding. It may provide simple summaries of the sample and the conducted measures.

3. Result and Discussion

Table 1 presents the result of fitness test. The students’ weight distribution is in the range of 42-66 kgs with over 155 cm heights as required by the polytechnic. The students’ heart rate is measured after they performed the physical test. Their heart rate is in range of 102-120.

| Respondent Id | Weight (Kg) | Average Time (minutes) | BMI  | Heart rate | VO2 Max |
|---------------|-------------|------------------------|------|------------|---------|
| R1            | 54          | 6.69                   | 21.6 | 110        | 76.1    |
| R2            | 57          | 7.20                   | 22.5 | 103        | 75.0    |
| R3            | 54          | 6.82                   | 22.5 | 108        | 76.0    |
| R4            | 49          | 7.34                   | 19.4 | 114        | 74.2    |
| R5            | 66          | 7.17                   | 26.4 | 110        | 72.5    |
| R6            | 51          | 7.43                   | 22.4 | 112        | 73.9    |
| R7            | 50          | 7.11                   | 21.1 | 113        | 75.0    |
| R8            | 53          | 7.57                   | 22.6 | 102        | 74.7    |
| R9            | 46          | 7.57                   | 18.2 | 115        | 73.8    |
| R10           | 56          | 7.28                   | 21.6 | 116        | 72.9    |
| R11           | 49          | 6.29                   | 19.6 | 117        | 77.2    |
| R12           | 58          | 6.77                   | 22.7 | 102        | 76.8    |
| R13           | 46          | 8.19                   | 18.0 | 107        | 73.4    |
| R14           | 50          | 6.07                   | 18.9 | 120        | 77.7    |
| R15           | 40          | 6.08                   | 16.4 | 109        | 81.0    |
| R16           | 51          | 7.21                   | 21.5 | 106        | 75.9    |

Table 1. Fitness Test Result
Since all respondents is in the same gender, it can be seen that all students have VO2Max over 51, means that they are in excellent fitness level [6[24]]. The BMI of respondents is in range of 16.4 to 26. Their average running time is from 4.96 to 8.19. Here, we can conclude that students with lower BMI will run faster than one with higher BMI. Furthermore, the students with the highest VO2Max (82) is also recognized as the fastest runner. It is match with the previous research of [12], where students with higher BMI may have lower VO2Max [25]. In other words, fat students may have a low fitness.

The result of competency test is showed by Table 2. None of the students can pass the test in one turn. Most of them (80%) need to do remedial test two times to get a minimum passing score. Four students need only 1 more test, while one student has to do the 3rd remedial test.

Figure 1 shows the percentage remedial test. Here, we assume that the student who did more remedial test is the student with the lower academic performance. As presented in Figure 1, the two cleverest students, need one remedial test. They have the highest VO2Max classification. Furthermore, the most population have to do two remedial tests. Thus, the student with low academic performance has the low level of the VO2Max.

In this far from perfect study, we face difficulties on concluding the research results. The main reason is that all students are in excellent fitness condition. The other reason is that the applied descriptive analysis is not adequate to reveal the correlation between VO2Max and the number of remedial test. This preliminary research should be more explored by using more sophisticated method. A linear regression with a Pearson’s R correlation should be used to find significant correlation the learning outcome with the healthy body [26], [27].

Mens sana in corpore sano a healthy mind in a healthy body. This phrase express that physical exercise is a crucial part of mental and psychological condition. In context of engineering and polytechnic, the implemented curricula should be reviewed based on the changing global environments. The academic environment can be an effective and efficient medium on influencing the students’ health [28], [29]. Implement a health-related physical education curriculum can potentially advantage students [30]–[33]. Furthermore, universities must make establishment for engineering subjects [34], teaching and learning material combined with proportional physical activities which are updated and capable of enhancing the skills and attributes of the next generation of engineers.

| Respondent Id | Weight (Kg) | Average Time (minutes) | BMI | Heart rate | VO2 Max |
|---------------|-------------|------------------------|-----|------------|---------|
| R17           | 43          | 6.93                   | 18.1| 104        | 78.5    |
| R18           | 51          | 6.95                   | 19.0| 120        | 74.6    |
| R19           | 52          | 6.16                   | 21.6| 111        | 78.4    |
| R20           | 51          | 4.96                   | 17.2| 114        | 82.0    |
| R21           | 57          | 7.58                   | 19.5| 127        | 70.4    |
| R22           | 62          | 6.67                   | 25.2| 121        | 73.5    |
| R23           | 44          | 6.80                   | 19.3| 106        | 78.5    |
| R24           | 63          | 7.05                   | 24.0| 109        | 74.0    |
| R25           | 65          | 8.14                   | 26.0| 109        | 70.1    |

Table 2. The Result Of Competency Test
4. Conclusion
The research finds that the lower BMI may increase the VO2Max. However, since all respondents are in their very fit condition, it is hard to describe that their competency is related to their fitness as well as the number of test that they did. Thus, further research with deeper technique should be conducted. It is necessary to do research on the correlation between fitness and students learning outcome. The research should concern on perceptions of their discipline and also career opportunities [35]. Various learning approaches such problem and project based learning should be considered to improve the students learning outcome [35]–[37]. The future research should involve different respondents with various gender [11], ages [17], social-economic condition [38] and also their intelligence quotient (IQ) [39]. Similar research is also visible for lecturers and laboratory technicians as research objects. The
use of SOFIT [40–[42], an objective assessment of the physical education quality, is potential for the future research. The tool measures the student activity levels, lesson context, and teacher behavior during class time. Thus, the research finding might be presented more systematically.

References

[1] Lin J-W Yen M-H Liang J-C Chiu M-H and Guo C-J, 2016 Examining the Factors That Influence Students’ Science Learning Processes and Their Learning Outcomes: 30 Years of Conceptual Change Research EURASIA J. Math. Sci. Technol. Educ. 12, 10 p. 2617–2646.
[2] Honieke T and Broadbent J, 2016 Literature review - The influence of academic self-efficacy on academic performance: A systematic review Educ. Res. Rev. 17 p. 63–84.
[3] Cekiso M Arends J Mkabile B and Meyiwa T, 2016 Investigating Relationship between Accounting Students’ Learning Style Preferences and their Academic Performance at a University of Technology in South Africa 47, 3 p. 211–217.
[4] Suswanto H Asfani K and Wibawa A P, 2017 Contribution of teaching performance, learning satisfaction and achievement motivation to students’ competence achievement Glob. J. Eng. Educ. 19, 1 p. 66–71.
[5] Asfani K Suswanto H and Wibawa A P, 2016 Influential factors of students’ competence World Trans. Eng. Technol. Educ. 14, 3 p. 416–420.
[6] Kadlowec J A and Navvab A, 2012 Using sports in engineering to teach mechanics of materials Glob. J. Eng. Educ. 14, 1 p. 34–39.
[7] Klement M and Klementová S, 2016 Benefits of the Support of Polytechnic Education for Non-technical Schools’ Students Procedia - Soc. Behav. Sci. 217 p. 149–159.
[8] Nguyen D Q, 1998 The Essential Skills and Attributes of an Engineer: A Comparative Study of Academics, Industry Personnel and Engineering Students Glob. J. Eng. Educ. 2, 1 p. 65–76.
[9] Besterfield-Sacre M Atman C J and Shuman L J, 1997 Characteristics of Freshman Engineering Students: Models for Determining Student Attrition in Engineering J. Eng. Educ. 86, 2 p. 139–149.
[10] So E S and Park B M, 2016 Health Behaviors and Academic Performance Among Korean Adolescents Asian Nurs. Res. (Korean. Soc. Nurs. Sci). 10, 2 p. 123–127.
[11] Lee R L T and Loke A J T Y, 1997 Health-promoting behaviors and psychosocial well-being of university students in Hong Kong. Public Health Nurs. 22, 3 p. 209–20.
[12] De Araujo S S Miguel-Dos-Santos R Silva R J S and Cabral-De-Oliveira A C, 2015 Association between body mass index and cardiorespiratory fitness as predictor of health status in schoolchildren Rev. Andaluza Med. del Deport. 8, 2 p. 73–78.
[13] Takken T Bongers B C Van Brussel M Haapala E A and Hulzebos E H J, 2017 Cardiopulmonary exercise testing in pediatrics Ann. Am. Thorac. Soc. 14 p. S123–S128.
[14] Shadiqin A R, 2013 Comparison of Blood Cholesterol Profiles Before and After The Measurements of Maximum Aerobic Capacity ( VO 2 max ) J. Wetl. Environ. Manag. 1, 1 p. 16–24.
[15] Black N E Vehrs P R Fellingham G W George J D and Hager R, 2016 Prediction of VO2max in Children and Adolescents Using Exercise Testing and Physical Activity Questionnaire Data Res. Q. Exerc. Sport 87, 1 p. 89–100.
[16] Carney C McNeish S and McColl J, 2005 The impact of part time employment on students’ health and academic performance: a Scottish perspective J. Furth. High. Educ. 29, 4 p. 307–319.
[17] Castelli D M Hillman C H Buck S M and Erwin H E, 2007 Physical Fitness and Academic Achievement in Third- and Fifth-Grade Students J. Sport Exerc. Psychol. 29, 2 p. 239–252.
[18] Grissom J B, 2005 Physical fitness and academic achievement J. Exerc. Physiol. 8, 1 p. 11–25.
[19] Tomkinson G R Olds T S Kang S J and Kim D Y, 2007 Secular trends in the aerobic fitness test performance and body mass index of Korean children and adolescents (1968-2000) Int. J. Sports Med. 28, 4 p. 314–320.
[20] Rikli R E and Jones C J, 1998, The Reliability and Validity of a 6-Minute Walk Test as a Measure of Physical Endurance in Older Adults, *Journal of Aging & Physical Activity*, 6. p. 363–375.

[21] Byars A Greenwood M Greenwood L and Simpson W, 2003 the Effect of Alternating Steady-State Walking Technique on Estimated Vo2Max Values of the Rockport Fitness Walking Test in College Students. *J. Exerc. Physiol. Online* 6, 2 p. 21–25.

[22] Ali C A and Akayuure P, 2016 Infusing Competencies and Skills of Vocational Instructors : Innovations to Boost Science and Technology for National Development *Am. Sci. Res. J. Eng. Technol. Sci.* 18, 1 p. 219–234.

[23] Ushatikova I I Rakhmanova A R Kireev V S Chernykh A O and Ivanov M A, 2016 Pedagogical bases of formation of key information technology competencies polytechnic institute graduates *Int. J. Econ. Financ. Issues* 6, 2 p. 283–289.

[24] Davies C T M, 1973 Relationship of maximum aerobic power output to productivity and absenteeism of East African sugar cane workers *Br. J. Ind. Med.* 30, 2 p. 146–154.

[25] Östenberg A and Roos H, 2000 Injury risk factors in female European football . A prospective study of 123 players during one season Injury risk factors in female European football . A prospective study of 123 players during one season *Scand. J. Med. Sci. Sport.* 10, April p. 279–285.

[26] Anderson A S and Good D J, 2017 Increased body weight affects academic performance in university students *Prev. Med. Reports* 5 p. 220–223.

[27] Resaland G K et al., 2016 Effects of physical activity on schoolchildren's academic performance: The Active Smarter Kids (ASK) cluster-randomized controlled trial *Prev. Med. (Baltim).* 91 p. 322–328.

[28] Shariff Z M et al., 2008 Nutrition Education Intervention Improves Nutrition Knowledge , Attitude and Practices of Primary School Children : A Pilot Study *Health Educ.* 103 p. 119–132.

[29] Higgins S Hall E Wall K Woolner P and McCaughey C, 2005 The Impact of School Environments: A literature review.

[30] Sallis J F McKenzie T L Alcaraz J E Kolody B Faucette N and Hovell M F, 1997 The Effects of a 2-year Physical Education Program (SPARK) on Physical Activity and Fitness in Elementary School Students. Sports, Play and Active Recreation for Kids. *Am. J. Public Health* 87, 8 p. 1328–34.

[31] Cavill N Pediatric Biddle S J H and Sallis J F, 2001 Health Enhancing Physical Activity for Young People, Statement of the United Kingdom Consensus Conference *Pediatr. Exerc. Science* 13 p. 12–15.

[32] Basch C E, 2011 Healthier Students Are Better Learners: A Missing Link in School Reforms to Close the Achievement Gap *J. Sch. Health* 81, 10 p. 593–598.

[33] St Leger L and Nutbeam D, 2000 A model for mapping linkages between health and education agencies to improve school health. *J. Sch. Health* 70, 2 p. 45–50.

[34] Rugarcia A et al., 2000 The Future of Engineering Education L a Vision for a New Century *Chem. Eng. Educ.* 34, 1 p. 16–25.

[35] Mohedas I Kaufmann E E Daly S R and Sienko K H, 2015 Ghanaian undergraduate biomedical engineering students’ perceptions of their discipline and career opportunities *Glob. J. Eng. Educ.* 17, 1 p. 34–41.

[36] Sienko K H Sarvestani A S and Grafman L, 2013 Medical device compendium for the developing world: A new approach in project and service-based learning for engineering graduate students *Glob. J. Eng. Educ.* 15, 1 p. 13–20.

[37] Mills J E and Treagust D F, 2014, ENGINEERING EDUCATION – IS PROBLEM- BASED OR PROJECT-BASED LEARNING THE ANSWER?, in * AUSTRALASIAN JOURNAL OF ENGINEERING*, June, .

[38] Voorn R J J and Kommers P A M, 2013 Social media and higher education: introversion and
collaborative learning from the student’s perspective *Int. J. Soc. Media Interact. Learn. Environ.* 1, 1 p. 59.

[39] Li Y S Yu W P Liu C F Shieh S H and Yang B H, 2014 An exploratory study of the relationship between learning styles and academic performance among students in different nursing programs *Contemp Nurse* October 2014 p. 4470–4499.

[40] Mckenzie T, 2012 SOFIT, System for Observing Fitness Instruction Time p. 1–18.

[41] Rowe P van der Mars H Schuldheisz J and Fox S, 2004 Measuring students’ physical activity levels: Validating SOFIT for use with high-school students *J. Teach. Phys. Educ.* 23, 3 p. 235–251.

[42] Hannon J C, 2013 Physical Activity Levels, Lesson Context, and Teacher Behaviours in Elementary Physical Education Classes Taught by Paraeducators *Int. J. Elem. Educ.* 2, 3 p. 23.