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EFFECTIVENESS OF THE INQF-BASED LEARNING ON A GENERAL PHYSICS FOR IMPROVING STUDENT'S LEARNING OUTCOMES

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Abstract. *This research aims to analyse effectiveness of the Indonesian National Qualification Framework (INQF)-based learning on General Physics to increase the sixth level student's Learning Outcomes (LOs) according to the INQF indicators and student's skills in using physics laboratory equipment. This research was conducted using two groups of students that consisted of 29 and 30 students. A preliminary test (pre-test) and a post-test were applied to the groups that assumed to have the same level of knowledge and skills. The data were analysed using the paired t-test, the n-gain, and the ANOVA. The results show that the INQF-based learning applied to the General Physics effective in increasing the student's LOs according to the INQF indicators. Moreover, the n-gain scores between the pre-test and the post-test can be categorized as moderate for the sixth level student's LOs and categorized as high for the student's skills in using the physics laboratory equipment.*

Key words: *INQF-based learning, general physics, student's learning outcomes.*

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Introduction

In this 21st century, there are several essential "student's skills, knowledge and expertise that should be mastered to succeed in work and life in the 21st century". An example of the required skills is the problem solving skills (Partnership for 21st Century Skills, 2009). Problem solving skills covering a wide range of capabilities, including procedural and non-procedural problem solving capabilities (Pretz, Naples, & Sternberg, 2003). In the context of General Physics learning, step by step of the problem solving skills are needed to be trained continuously for both the procedural and non-procedural problem solving. Moreover, problem solving in General Physics requires skills of using the physics laboratory equipment.

It is generally understood that in order to achieve the 21st century skills, it requires a certain qualification requirements (Griffin & Care, 2015). Qualification defined as a formal outcome of an assessment and validation process which is obtained when a competent body determines that an individual has achieved learning outcome (LOs) to given standards (Allais, 2014; James & Dorn, 2015). National qualifications system is related to the national recognition of learning and other mechanisms that links education and training to the labour market and civil society. It may include development and implementation of institutional arrangements and processes relating to quality assurance, assessment and appreciation (European Communities, 2008; Ure, 2015).

National qualifications framework (NQF) had been set up in three European countries: Ireland, France and the UK before 2005. It is reported in 2015 that the framework is currently being developed in 38 countries cooperating on the European qualifications framework. Some studies showed that the NQF had significant impact on education, training, and policies on working practices (James & Dorn, 2015; Chakroun, 2010; Gosling, 2011).

Recently, Indonesia established a similar framework which is called Indonesian Qualification Framework (INQF; In Indonesian it becomes *Kerangka Kualifikasi Nasional Indonesia* (KKNI)). It was issued through the Presidential Decree No. 8 of 2012. The INQF aims to provide recognition of competence of work in accordance with the structure of employment in various sectors. The INQF is a level of qualification framework that aligns competence, equalization, and integration in the fields of education and vocational training, as well as work experience. The term qualification is defined as mastery of LOs conferring to a certain level in the INQF structure.

According to the INQF, there are nine qualifications from the lowest (level 1) to the highest (level 9). Levels 1-3 are all grouped as office operators, level 4-6 are grouped as office technicians or analysts and level 7 to level 9 are grouped as professional careers. The INQF structure categorizes undergraduate degree program in the field of education into the sixth level. The sixth level student's LOs are defined as follows: (i) able to apply their expertise and utilize Arts and Sciences (science and technology) in solving problems; (ii) mastering concepts in depth knowledge in their field and able to formulate a procedural problem solving; (iii) able to take right decisions based on analysis of information and data, and is able to provide guidance in selecting various alternative solutions independently or in groups; and (iv) responsible for their own work and accountable for achievement of organizational work (Jatmiko, Widodo, Martini, & Budiyanto, 2014).

In line with the INQF structure, the Minister of Education and Cultural Affairs issued Regulation of the Minister of Education and Culture No. 49 of 2014 on Higher National Education Standards. This regulation requires a learning process in a higher degree institution that leads to the achievement of LOs indicators of the INQF. Through the new standard, it is clear that the regulation gives no other choice for higher degree institutions in Indonesia for not implementing learning process that leads to achievement of LOs indicators according to the INQF.

Studies related to the NQF in the field of education in several countries show that: (i) in Europe, the NQF is associated with the increase of the learning outcomes from input to output (Ure, 2015); (ii) in Chile, the NQF links to the formulation of principles and criteria for education instrument implementation for the qualification framework (Solís, Castillo, & Undurraga, 2013); and (iii) in Portugal, the NQF serves as an assessment tool which allows diagnosing and controlling the development of learning achievement (Stasiūnaitienė & Teresevičienė, 2006). In general, it showed that the NQF provided significant impact on the improvement of the learning outcome scores (Chakroun, 2010)

Series of researches related to the INQF on education field at the State University of Surabaya in Surabaya - Indonesia had been commenced since 2013. The research mainly focused on developing prototypes of the INQF-based curriculum to enhance professional and pedagogical competence of science education teachers. The work had successfully published a book entitled of "Book in prototyping INQF-based science education curriculum 1st Edition" in 2014 (Jatmiko, Widodo, Martini, & Budiyanto, 2014). Subsequently, a limited test (including 15 students) was done for the INQF-based learning on a General Physics for students in bachelor degree of science education program at the State University of Surabaya. The results had been reported in the article in a national seminar in Surabaya-Indonesia (Jatmiko, Widodo, Martini, & Budiyanto, 2015). Based on the results of the research described in the article, a book had been published entitled of "Book of Prototyping INQF-based Curriculum for the science education curriculum 2nd Edition". The second edition book equipped with: (a) examples of the learning tools for the general physics research that based on the INQF and (b) learning syntax (flow of instructional activities) according to the INQF sixth level of students' LOs indicators, i.e. (1) motivating, (2) presenting information and experimental groups/discussion sharing, (3) identifying and solving problems, (4) establishing and enriching, and (5) evaluating the use of science and technology (Jatmiko, Widodo, & Martini, 2015).

The sixth level INQF indicators covers (i) mastering concepts, (ii) formulating procedural problem-solving, (iii) formulating non-procedural problem-solving, and (iv) decision making. The concept indicators may include: remembering (C1), comprehension (C2), applications (C3), analysis (C4), evaluation (C5), and creation (C6) (Krathwohl & Anderson, 2001; Bush, Daddysman, & Charnigo, 2014). On the other hand, procedural problem solving may include indicators such as: (i) observation, (ii) asking questions, (iii) making hypothesis, (iv) testing the hypothesis, (v) analysing the data and conclusions, and (vi) replicating research through the obtained correspondence between empirical and theoretical (Bradford, 2015). The non-procedural problem solving indicators are: (i) arguing that is defined as capability of reasoning in accordance with his/her experience and knowledge, (ii) strategic indication that is capability of selecting appropriate problem-solving strategies based on analysis, and (iii) solution evaluation that is considered as capability to evaluate solutions to problems logically correspond to the case description, analysis, and experimental data to support decision making (Snyder & Snyder, 2008). Lastly, the decision making comprises of ability in: (i) determining the objectives, (ii) identifying options, (iii) analysing the information, and (iv) making a choice (Campbell, Lofstrom, & Brian, 1997).

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