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WHERE IS THE DIRECTION OF PHYSICS EDUCATION?

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Abstract: This article discusses the direction of physics education in the future. This discussion covers physics education, career and technology, and learning to live together and throughout life from a literature study. An extensive study of literature is intended to show the direction of education, especially physics education. The basis of this article is by reviewing research, surveys and online books from several references. Overall, this paper draws conclusions for physics education majors. So the following narratives describe careers that are integrated with technological developments, educational innovations, alternative learning methods/models for physics education.

Keywords: physics education, career, life together & lifelong learning

Introduction

The explicit mission of many universities is to improve the quality of each faculty. Quality improvement is pursued in the formation of quality, character and dignified graduates. These efforts have an impact on curriculum renewal for each generation. But the question, is it to be a solution to create the human resources in the future?

The focal point of this discussion the direction of physics education majors is more explicit. This article explains, 1) What is physics education, 2) What is the relationship between career and technology in Physics Education programs? 3) What is the importance of learning to live together and throughout life for those in the field of physics education?

A. The essence of physical education

Physics education comes from two words. That are education and physics. Education is a process of self-development that requires a process of awareness to form a habit. Physics is a basic comprehending understanding to know the complexity of modern technology and knowledge to form a tech-savvy society [1].

According to research [2] there are three in-depth conclusions about physical education, include; 1) if viewed from an etymological perspective and with ontological, epistemological and axiological grounds, physics education is one of the autonomous fields of science; 2) physics education is an objective, methodical, systematic and systemic, universal and dynamic science; 3) physics education becomes a means to develop knowledge. So, from these three points, physics education is an independent science.

As a stand-alone science, it is natural that physics education becomes a study program that has many experts in it. Physics education experts who continue to develop their knowledge. As seen in current trends in physics education research [3-4]. The science that explains and provides new knowledge in the field of physics education. Related examples; innovations teaching physics education, physics education for children with disabilities, physics education for solutions to improve the society capable of technology and teacher attitudes towards physics education itself. All that is obtained in organized activities in the physics education study program.

In general, the learning process in the physics education study program is divided into 2 phases. The first phase is an understanding of the discussion of concepts, theories about education or about physical content. In this section, some learners find it difficult [5]. The second phase is practical learning. Teaching practices in schools or microteaching/peer teaching at University. Both of these phases will complete the science of physics education before undertaking final research

Learning in theory and practice is a series of learning courses in physics education studies. The scope of physics education will be summarized in the learning curriculum. The learning curriculum in tertiary institutions in the physics education study program has a broad scope and in accordance with the instructors needed [6]. The extent includes self-awareness, a human attitude that requires scientific study of content and social learning every time discussing physical objects. As is usually the case with the content of physical objects ranging from classical physics, modern to quantum, optical, and heat. While socio-learning is how the nature of physics education is related to the environment, nature, and humans as well as how physics is a bridge of life together and lifelong learning.

To be a part of physics education, a learner must possess the following attitudes and characteristics; 1) Thorough, 2) Details, 3) Rational, 4) Structured, 5) Diligent, 6) Critical, 7) Observant, 8) Insightful, 9) Enjoy doing research, 10) Happy to count, 11) Happy to analyze, 12) Have Intrapersonal

skills and self-management [7], 13) Having communication skills and;

other than that, from the research that has been done [8-9], it should be that the physics education students must be equipped with practical skills. The goal is to have good science process skills

B. The essence of life together and lifelong learning

In the discussion of the nature of life together and lifelong learning will be translated into two. First is the essence of life together and second is lifelong learning. Both of these discussions have links to one another. But it has different tips and tricks.

First, the essence of life together has a broad understanding and perspective. Freeing students to portray themselves in a broader social environment that includes aspects of humanity, society, statehood, and spirituality is part of the nature of life together [10]. The deeper meaning is a desire to coexist, complete, and maintain relationships among humans or the environment/nature. The essence of life together is also the ethics of education [11] which requires that its needs be met

The need to live together, one of which was spearheaded by globalization. Globalization moves jobs, people, products, and ideas throughout the country into one. Indirectly the desire to live together will be absolute.

Another reason is global warming. Global warming is also the basis of why we must understand the nature of life together. To carry out a balanced life, human harmony must have the knowledge to preserve nature, to strive for the prevention of widespread global warming.

Diversity also provides equal opportunities to justify and require to live together. The aim is to create a harmonious environment. Harmony must also occur in the learning environment. Teaching must include the value of diversity in the learning process. This, according to the results of research [12] that good education requires education about diversity in diverse environments

The Second Understanding is the desire for lifelong learning. Lifelong learning refers to the basic behavior of life which is time is knowledge. The broader meaning; Learning that starts from childhood, adolescence, adulthood to old age. It all covers how to manage interpersonal social, reflect self-confidence systems, and are oriented towards new experiences. Most lifelong learning processes occur unconsciously (tacit knowledge). This is a process to increase self-capacity continuously.

The desire to increase the capacity of knowledge can be raised from internal and external factors. Internal factors are influenced by something in a person (mindset), attitude [13], motivation [14] and feelings that just grow (talent) to want to know. External factors come from outside oneself, teacher, school [15] and the environment.

The desire to learn for a lifetime can be influenced/influence certain information which is mainly related to career choices and practical needs of daily life. Learners are said to develop if the performance has high effectiveness. Achieving it requires lifelong learning. Because problems will not be the same from time to time. So that requires knowledge, innovation, new solutions, and that is the importance of lifelong learning. In addition, an open attitude to the renewal of knowledge and the linkage of one science to another [16] is also important for learners. According to the center of research and innovation [17] lifelong learning includes religious, moral, ethical, and social values. Some other research in the field of technology requires human resources who are able to find the latest innovations in the field.

C. Technology and career

in general, the career of physics education is a teacher. Education has a broad meaning that is giving facilities to those who want to learn natural wonders, natural order, universal phenomena, and how someone to know the development technology.

Technology and knowledge cannot be separated from education. One of them is physics education. technology-based learning is recommended to help the learning process [18]. This is intended to compensate for future careers that must be integrated with technology. In other cases, there is a relationship between technology, education, and career in a civilization

This is seen from the advanced civilization of the people who have extensive knowledge, are educated and have regular, efficient, productive life activities. All of these are centered on institutions that have professional teachers. As in some American states, being a physics teacher is expected to have high professional levels [19].

The following are some of the career options that are referenced for those who have finished their physics education program studies.

1. Researchers in the field of education focus on physics education,
2. Curriculum developers focus on the field of physics education,
3. Developers of teaching materials focus on the field of physics education,
4. Expert in teaching/survey team to assess teacher/evaluation team focus on physics educators,
5. Teacher/pursuer/entrepreneur/tutor,
6. Educators for children with special needs in the field of physics,
7. Instructors in special laboratories for school laboratories,
8. Become an entrepreneur.

Some of the careers above were obtained from Google source projects, some of which require special skills. This proves that experience, skills, and desire to learn have a role in having a good career[20].

Method of research

This study focuses on physical education, career, technology and learning to live together for life. This goal will be achieved by investigating the literature related to the topic. This research is planned as a literature-based study. Basic literary sources with the help of online search engines and databases such as Google Scholar, ERIC, Scopus, Wiley Digital Archives, Taylor & Francis Online, and several related online sources. Some of the required data come from books and printed articles from the campus library that are used to find related literature.

Results and Discussion

The nature of the department of physics education must develop broader educational knowledge for physics. Physics education is compulsory learning for junior and senior high schools in Indonesia. Therefore the scope of physics education must be broad not only around concepts and content but how humans can understand the substance of all learning activities.

Such as attitude [21], behavior, motivation and learning environment and matching the education system for all students (inclusive education) [22-25]. Including the important role of a teacher to match learning methods with student needs, and understand how students think [26]. Like, doing the learning process using technology, learning to understand students' needs (special needs, because some of them have an interest in learning physics [27-29], science [30] and they can count [31]) which different. Differences in cognitive abilities, needs, gender [32], [33], and learning difficulties.

Based on physiological and methodical reviews, physics education can develop in accordance with the wishes of the times and increasingly sophisticated technological shifts such as in this century. To support making future resources in physics education majors must provide creative innovation for graduates. Creative innovation that is intended is the department of physics education must apply technological proficiency, learning by doing, ready to face all the possible needs of learners, and have a sensitivity to what is needed for the environment. Because knowledge develops in line with the development of the environment.

Furthermore, knowledge is in line with the attitude of modern life, the attitude of life together, lifelong learning. So, physics education must also be able to direct learners to prioritize the essence of life together and learning for a lifetime. Because the demands of future educated generations are "how collaboration is the key to modern civilization".

Many researchers have mapped and started to explore the trends of physics education research [34]. Some of them [35] state several topics that are developing in research in physics education;

1. Conceptual Understanding; Most physical education research has looked at what students know and how they learn. As the development of learning methods for children with special needs[36].
2. Epistemology; study the theories of cognition involved in learning physics.
3. Problem Solving; physics education is considered a problem solver, the underlying mental processes that are relevant to social-natural problems.
4. Attitude; There is a lot of research on students' attitudes and expectations about physics [21].
5. Social Aspects; discuss gender, collaboration, and interaction between students and race-related to physics education.
6. Technology; illustrate to students the connection between the real world and abstract representations of the scientific realities of physics. And using learning technology to improve physics learning outcomes.
7. Evaluation of Specific Instructional Interventions; A number of studies have reported on the educational impact of various pedagogies, especially physics.
8. Instructional Materials; includes physics education with research that develops standards for how curriculum development has proven to be effective in the classroom.

Some of the research topics above are the basic stages to expand the scope of physics education. The extent of the scope of physics is expected to be able to expand the careers of physics education alumni. As can be predicted that education without innovation will reduce the quality of education itself.

Physics education is still weak when viewed from the careers provided at this time. Like, there has not been a serious look at career space for children with special needs [37]. So that innovation is needed, increasing the breadth of branches of science and physics education experts. the aim is to continue to develop a broader scope of physics education. Besides that, it is also expected to be influential to foster a lifelong learning attitude.

Lifelong learning is a belief about values, ideology, and life orientation. Lifelong learning leads to all the ways a person faces challenges and experiences change. Why is that? because of the complexity as educators, policymakers, and researchers consider new views about the role of culture and learning in physics education. Here are

the characteristics that illustrate why you have to learn throughout life;

1. Learning takes place not only in school but also in a variety of contexts and practices of everyday life that are valuable throughout life. As a teacher, it is important to realize that teenagers are students who have perspectives and experiences that are valid knowledge bases and resources for a formal educational experience. Teachers need to diversify pedagogical approaches in ways that integrate new media, technology, experience and student knowledge to enrich student learning. Educators must understand and pay attention to the wide variety of textual media students involved and utilize them as educational resources.
2. For all students need a variety of sources of support from various aspects to develop their personal and intellectual potential [33]. Programs, resources, and incentives must be created that enable a community to identify learners to achieve maximum learning achievement.

Lifelong learning cannot be avoided in society. Why? Because knowledge orientation will continue to develop. This implies that the school system must have new goals and characteristics for each period. That is, the learning process will continue throughout life for someone [38]. There is no word of education completed when a student leaves an educational institution. The success of wider educators is when they are able to lay a foundation on students to strive to become lifelong learners, towards a tech-savvy society.

Where the purpose of learning physics is to accelerate towards a tech-savvy society (using technology efficiently, productively, and creatively at work) and to uphold the essence and dignity of godly people.

Physics learning in higher education does not only train students (prospective teachers in general) to hold the hands-on experience that finally finds the limitations of what they have, understands the physical language of physics and the concepts of mathematics-physics. But can realize that learning requires others, learning physics upholds togetherness to connect physical knowledge with social life and lifelong learning.

Discusses physics teaching research that focuses on what is best for students from the point of view of physicists and science educators are;

1. The correct connection between physics content and educational principles. This can act as a catalyst in the view of physics education.
2. Making physics knowledge more accessible to everyday students and those who want to continue studying physics at university [39].

Next on the important point of UNESCO for education is learning to live together. Life together is to create peace in diversity amid the issues of globalization. This is why learning to live together is an important part of education.

Learning to live together is a new resource needed to further cultivate ethics and values in children and help build a better world. With a deep understanding, learning to live together aims to foster moral intelligence, and critical thinking, children and young people will be better prepared to face the challenges of making the best choices in the world with a variety of influences and choices [11].

To create learning to live together must combine traditional and modern learning methods. Here are the tricks for creating learning to live together;

1. The learning approach must lead to a methodology that provides space for the exchange of ideas/information, interactions, meetings, discoveries, critical thinking, reflection, and action. This method is designed to promote active participation, involvement, and connection with others.
2. Experience-based learning; Experience-based methodologies can be developed through several techniques, including simulations, games, role plays, service learning and field trips.
3. Cooperative-based learning; Cooperative based learning techniques are joint projects, games and role-plays.
4. Problem-based learning; this methodology can be used by role-playing, analyzing case studies, social dilemmas, and problems, or by techniques that involve experiential learning.
5. Discussion-based learning; They can be based on case studies, real-life stories and dilemmas, or on films, pictures, and relevant songs. Discussions will often benefit from the direction of a facilitator. It is recommended to use participatory techniques to summarize ideas and find connections between them. These techniques include mind maps, concept sketches, and meta-plans or card techniques.
6. Introspection-based learning; introspection gives participants the opportunity to identify and evaluate their inner thoughts, feelings, and desires. This is very important for intercultural and interfaith programs for ethical education because it allows children to reflect on their values and attitudes. It's also useful when assessing change and personal commitment. Introspection can occur individually or in groups. Techniques such as meditation, when quiet or other contemplative exercises help participants create self-reflective experiences.

Conclusion

Education, career, technology and the will to live together and throughout life is a discussion of the affirmation of the central role of education in society. So that the full meaning for physics

education is a knowledge to study about the development of what one has to understand the natural scientific principles, technology, and the benefits of something that can facilitate human performance, and understand the phenomena formed from universal phenomena.

Pedagogical ability and content of a physics education graduate are important to note. However, adequate provisioning of technology will help graduates to prepare for careers a teacher later. Or, a successful teacher is not the teacher's ability to use the latest teaching methods, models and strategies. But, the ability of teachers to match this with the needs of different learners. Future careers cannot be predicted precisely, but preparing to be a successful learner is an educational mission. Learning orientation, Not a smart student/Claude graduate but those who must learn to live together and continue to be lifelong learners will be more meaningful to improve the quality of life and the local community.

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