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PHYSICS LEARNING INTEGRATED SCIENCE, TECHNOLOGY, ENTREPRENEURSHIP

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ABSTRACT

Educated unemployment in 2018 increased. This requires that Learning in Higher Education produces which are not only able to compete, but also able to produce employment. Entrepreneurial skills need to be drilled on students through integrated learning of science, technology, and entrepreneurship. For this reason, adequate references are needed to develop a sciencetechnopreneurship learning model. In this study have studied articles from international journals in the last period (2010 to 2019). For more specifically, we discuss several topics such as the parameters of technology-based learning, learning technopreneurship, and econophysics. Furthermore, this research reveals the role of role and technology is very important in this globalization era. The demands of the times require that learning be successfully integrated with technology, and be able to develop student entrepreneurial skills. From the data sources obtained there have been many developments of artificial intelligence-based learning media such as Reality Augmentation, and Virtual Reality, and learning using web media. But only a few studies have involved entrepreneurship so that technology-based learning has a wider role in improving the economic community. Learning technology based science Enhancing entrepreneurial skills has great potential to be developed. Through in-depth analysis this research is directed at discussing the development trends of learning models that integrate science, technology, and entrepreneurship.

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Introduction

The development of science learning in the 21st century began to be developed with technology-based learning, both in the process, assignments, and evaluations. The integration of science is inseparable from the demands of society that science and technology have an important role in the socioeconomic independence of the nation [1], [2], [3]. Learning is more directed at individual needs, develop interests and talents, and intelligence. Students need to be given the freedom to think and reason so that their creativity develops. Students are given the opportunity to explore armed with the knowledge they have and develop it through information technology.

Research trends during the last decades of this year reveal how science works in society, including the integration of the Economic of Science (NOS) in Natural of Science (NOS) to see how science works in society [4], Educational technology [5], Integrated Problem Based Learning STEAM [6], technology design in learning [7], technology integration in community-based learning [8], integration of technological science and social economy in physics learning [9], integration of technology and community science [10], strategy teaching physics by integrating social economy [11], the flip learning model as modern technology in learning [12], combining computer science and mathematics in physics learning [13], Educational Effects and Augmented Reality implications in the field of STEM [14], technology exploration as interactive learning media [15], web development for physics learning [16], technology-based game integration in community-based learning [17], reality augmentation integration in Problem Based Learning (PBL) [18], online game-based formative assessment using Inteligent Tutoring System (ITS) [19], science technology relations in physics text [2], social science in STS learning [20], Experiment Study Group (ESG) in STEM [21], Blended learning in learning [22], Integration of CLC (Community Learning Center) involving universities in distance learning as an effort to improve the economy in developing countries [36], Technology development in effective learning [33], technology integration in smartphone-based physics learning [32], STEM approach based on entrepreneurship skills [22], technology integrase in service learning [23], inquiry-based

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physics learning with technology improvement [23], a comprehensive study of online learning in Science and Engineering Education [24], Augmented Reality-based learning [25], technological transformation ogi and culture-based entrepreneurship [26], student involvement in web-based learning [27], activity analysis in science [28], entrepreneurship with scientific learning [29], learning innovation and entrepreneurship [30], technology-based adaptive learning (artificial intelligence) [31]. Of the many studies that reveal the integration of technology in science learning, only a few have integrated technology and entrepreneurship in science learning. Entrepreneurial skills are developed so that students not only have a scientific attitude, but can also see opportunities and take advantage of opportunities to gain profit (economic value).

Higher education has produced many graduates both bachelors and diploma. Almost all of these college alumni are trying to find work, although opportunities are very limited [29]. Finally, those who are unable to compete do not get work, and become unemployed. Statistical data for 2019 shows that in general the number of unemployed people in Indonesia in 2018 will decline. However, the number of educated unemployed, unemployment resulting from higher education both diploma and bachelor degree increased by around 25% [32]. This encourages the role of learning in higher education to form graduates who have the power of innovation and creativity, so as to develop entrepreneurship skills. University graduates are not only able to compete, but can create a field, and are able to see opportunities, and are able to take advantage of opportunities to improve the nation's economy. Students need to be given a stimulus, to be inspired, and their reasoning development [33], [34]

Developing student entrepreneurship skills not only gives him entrepreneurial theories, but students need to be given experience, so that entrepreneurial skills are truly gained from experience in the learning and learning process [34], [35], [36], [37]. Building an entrepreneurial spirit as well as forming a scientific attitude in learning, is not an instant. Need a gradual formation, continuous training, until it becomes a habit and finally forms character. Learning is directed at the application of Congress in people's lives. Students go directly to industry. It also needs to be trained to

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be an entrepreneur. Learning science is not only the development of scientific skills, but also socio-scientific [38], [1], [39].

The formation of entrepreneurship skills is not only the responsibility of entrepreneurs in entrepreneurship courses, but it is the joint responsibility of the managers of higher education. Entrepreneurial skills are realized through every learning, therefore it requires integrated learning, so that the dimensions of student understanding can be comprehensive, not narrow and able to play an active role in solving problems in the field. Economics of Science (EOS) and Natural of Science (NOS) are applied in learning science together [4]. The integration of EOS and NOS clarifies the role of science in society. Learning physics is not only theoretical, and mathematical calculations, the development of physics encourages the development of information technology.

Mathematics becomes a steward of science for the realization of old literacy (reading, writing, and arithmetic), but to realize new literacy (technological literacy, data literacy, human literacy), Information Technology is not just a steward but is a basic necessity in every discipline of science. Technology and mathematics are often solutions to understanding physical formulas [13]. Information Technology through science is able to realize scientific attitudes and creative figures who are able to see opportunities and take advantage of opportunities for profit (entrepreneurs). So hopefully no more educated unemployment produced by PT. But the role of science, technology, and entrepreneurship has not yet been fully explored. For this reason, this study aims to describe the role of science and technology in the realization of entrepreneurship skills.

2. Numerical Methods

2.1. Data Collection and Processing

Following in the footsteps of the explanation from some of the previous articles that it is very important to see articles from quality sources [40], [41]. For this, Scopus and Web of Science (WOS) were chosen as the main source of search for articles. In the Social Sciences Citation Index (SSCI) there are more than 3200 journals from 55 disciplines. Furthermore, the search is limited to, articles indexed in SSCI, usually articles that are indexed by SSCI are high quality articles. The time of publication, is

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limited to the last 10 years from 2010 to 2019, this is to see the research trends that are developing. Then set the search keywords, namely science/technology education, technopreneurship, and econophysics. Found about 95 articles. Articles were actually seen relating to the theme, and filtered back 76 articles left behind. In summary, data collection and processing can be seen in the following figure 1.

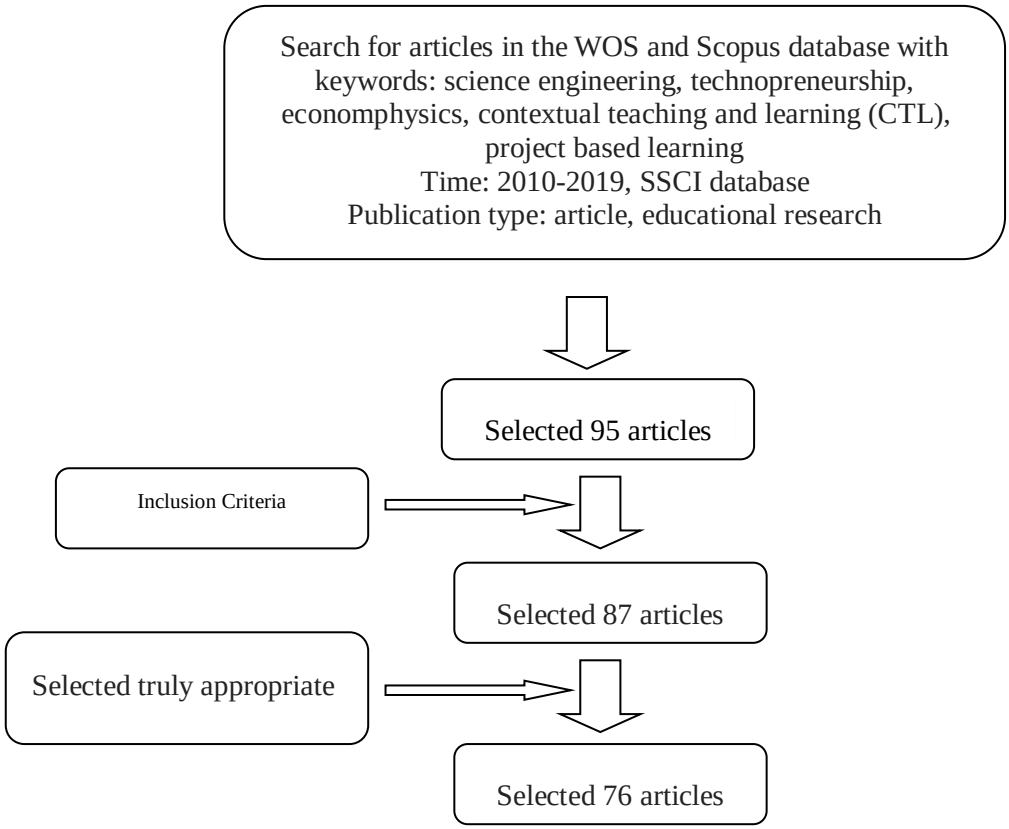

Fig 1. Article Data Processing Schema

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2.2.Coding

To find and investigate research trends in the integrated learning model of science, technology, and entrepreneurship, it is carried out in several stages, namely 1) Codes for science based on the type of technology used include: Science Technology, Technology, Blended Learning, Virtual Reality, and the web; 2) The code for Technopreneurship includes: mathematical engineering, Socio-scientific, community-based; 3) Econophysics: learning physics and entrepreneurship skills; 4) Learning models include: contextual models and project-based learning. The code that has been created is analyzed and seen for its consistency.

2.3. Theoretical framework

The theoretical framework used as a basis in this study is the theory of constructivism learning and behaviorism. Behaviorism emphasizes more on aspects of the need for behavior (behavior) that can be observed [42]. Behaviorism views an individual as his physical / physical figure and ignores mental aspects such as intelligence, interests, talents, feelings. Learning is a change in behavior as a result of experience, due to the stimulus (input) and response (output). Behavioral learning theories concerning respondent learning are known as Pavlov's Classical Conditioning theory, Skinner's Operant Conditioning theory, and Observational theories or social learning theory from Bandura [43].

Theory of constructivism emphasizes more on knowledge that is built for the construction of children's minds [43]. Theory of constructivism is widely used in learning science. Knowledge is obtained from the process of construction through equilibration between new knowledge and experience. The process of constructivism requires students and teachers to be equally active in the learning process. The teacher must actively build students' conceptions, direct and stimulate, and develop tasks that lead to the construction of knowledge.

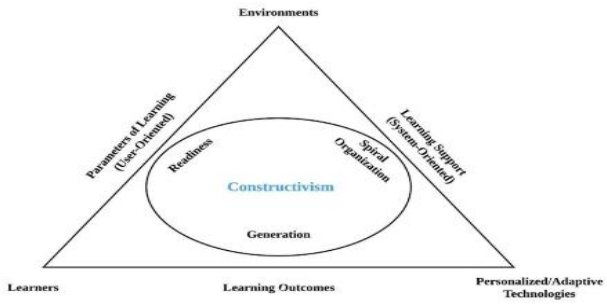

Fig 2. A theoretical framework of learning Constructivism

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Constructivism and behaviorime in the development of integrated learning models of science, technology, and entrepreneurship, presenting ways in the learning process through the use of technology and the habit of observing the environment with the application of technology in society from concepts and knowledge that has been constructed. Experience from the application of technology in this community will strengthen and develop the knowledge possessed.

3. Results and Discussion

From the results of searches that have been done, the classification is done based on keywords, and get the results as shown in Figure 4 below.

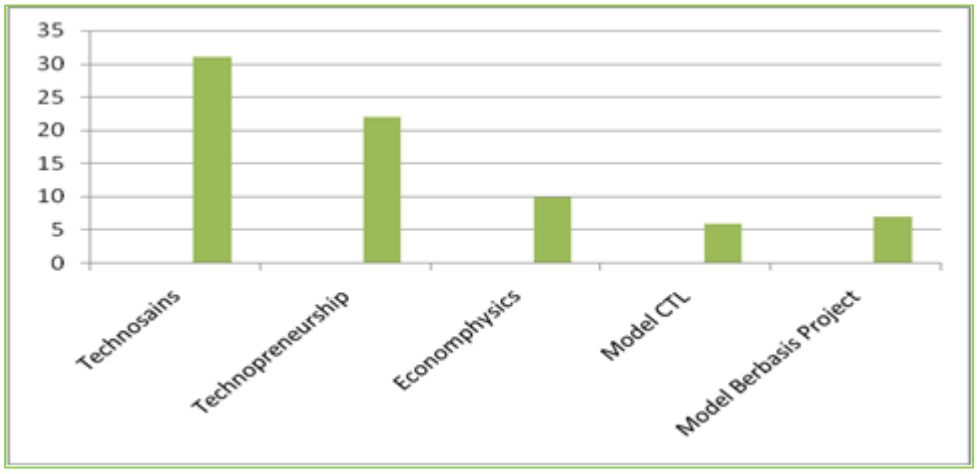

Fig 4. Article Search Results

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Search results based on keywords show results like in Figure 4 that research trends in the last decade of 2010-2019 are research related to Tecnosains. Technology-based science learning both in the process as a learning medium such as Virtual Reality and Augmented Reality or web development provides innovations that can increase students' spirit in Science learning [31]. Technological improvements in learning can also do increasing student activities so that learning outcomes can be increased [44]. Science and technology have a mutually reinforcing relationship [45], where scientific progress can be a driving force for technological progress, and technological development provides facilities / media for the development of science, especially physics.

Technoscience developed in learning physics cannot be separated from its application in community life. From the search results for articles on the category of developing trends in technology is a research that develops the Science Technology Society model (STS) which has been started in the previous decade. Now developing learning models of Science Technology Engineering Mathematics (STM) [46], [47]. In addition, the modification of STM/STS in the integration of socio-scientific learning is based. Learning science and technology is directed at scientific discussion and analysis of social problems that occur in the community [41]. Thus, learning science looks at how to work for the community. Technology-based science learning is also directed at web development, both in the learning process, assignments, and online evaluations [27], [14], [48], [16]. This web-based learning is not entirely online, there are still face-to-face sessions and some things that cannot be done online, such as practical work, and skills assessment. Web-based learning is mostly done by blended learning, or flip models [15], [12]. In addition, the increasingly sophisticated communication technology makes it easier for communication tools. Smartphone with a small shape, providing sophisticated facilities, so that anything can be done with an intelligent device that we can tremble and carry everywhere. This simply encourages learning to be done with car learning [41].

Technopreneurship-based learning is mostly done in vocational and technical majors. Entrepreneurship learning integrated with technology is needed in the industry 4.0 era.

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where all human activities can be done online [26]. Tecnopreneurship-based scientific learning was developed as an increase in student entrepreneurship skills [29], [30]. Technopreneurship is currently directed at learning congress the problems that exist in the community, assessment of local potential (ethnosains) and local culture (local wisdom) [26].

Articles in the Econophysics category have not been found too many. The use of physics equations is more widely used to analyze the condition of the nation's economic growth. Some technology-based learning, STEM aims to improve student entrepreneurship skills [47]. Within the international community of science educators recognize the important role of science teachers and the interdependence of science, technology and society in achieving scientific concern [41]. Knowledge of science with technology, media and its application in the community provides a stimulus to train the students' awareness of everyday problems and find solutions. By analyzing social problems in the community (socio-scientific) students are trained to develop their reasoning, constructing their knowledge based on experience gained.

Integratd learning of science, technology and society is carried out by presenting problems to be analyzed and contextualized physics products. This is intended one of them to overcome the impression that physics is theoretical and mathematical only [49], [10], [6]. Community technology, science enables students to explore applications for applied physics technology, so that they will train and develop students' entrepreneurship skills. The assignment of learning project assignments is also a stimulus for students to practice reasoning and develop their creativity. Students practice innovating, so that eventually they will get lots of ideas.

Physics learning model integrated science, technology, and entrepreneurship, many developed by assigning tasks in the form of learning projects [50]. Learning science and technology based projects require student competence in solving problems [51]. Project-based learning uses scientific knowledge to solve problems. Projects undertaken by students provide congressional experience, so ideas will emerge, and if these are accustomed to,

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entrepreneurship skills will form. These skills are empathy, self management, planning and organization, and problem solving analysis. Mental activities developed in project-based learning are defining assigned project models, designing models / prototypes, and managing them. Experience in learning this project will foster entrepreneurial skills. Entrepreneurship transforms knowledge into an effort that provides value, which is financial, scholastic, and communal [29].

Project-based learning also training students' skills for managing teams, client relations, communication, progressive and accommodating managing input [52]. This can be used to overcome the impression that inexact people tend to be selfish, lack communication, and are more likely to like working alone, and less able to work in teams. These skills are not instantaneous, need to be practiced continuously, until they become habits, and eventually they will form characters. The learning process is the process of forming experiences in response to stimuli that are intentionally or unintentionally presented [43]. Project-based learning enables tertiary education graduates to have competencies 1) to seek and use information efficiently; 2) the ability to work in teams wherever assigned; 3) creativity develops ideas and dares to speculate; 4) confident with your own work [53].

The use of technology is done to improve experience in project-based learning [54]. The technology in learning helps to get information, use it, manage it, and solve problems that arise in learning. Technology helps and facilitates all stages of the implementation of project-based learning, so technology becomes a very important medium. The assimilation of knowledge will be more rapid in the presence of technology, especially in this millennial era, where all activities are carried out through technological media. Project-based learning with technology integration will be more attractive to students because it is in accordance with their times and needs. Project assignments collected through web media further explore student creativity in packaging learning project assignments. The use of technology in Project Based Learning makes clear the real work of science in society [45]. Entrepreneurial skills allow to be realized in project-based learning with technology media.

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4. Conclusion

Sciencetechnopreneurship is a learning model that allows it to be developed by integrating science, technology, entrepreneurship. By using project-based learning techniques. The use of technology makes it easy for students to construct knowledge from their learning experiences. Behaviors that are familiarized in the project-based learning process will shape entrepreneurial skills. So that college graduates will have the competence 1) to find and use information efficiently; 2) the ability to work in teams wherever assigned; 3) creativity develops ideas and dares to speculate; 4) confident with your own work. University graduates are not only able to compete in the national or international community, but can create jobs, and can be well received in the community.

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