TRACK VIDEO ANALYSIS AS PHYSICS MEDIA RESEARCH DURING 2016 TO 2020: A BIBLIOMETRIC ANALYSIS

Hanandita Veda Saphira[1#], Nadi Suprapto[2], dan Woro Setyarsih[3]

[123]Jurusan Fisika, Fakultas Matemaika dan Ilmu Pengetahuan Alam, Universitas Negeri Surabaya, Indonesia
[#]Email: hanandita.19049@mhs.unesa.ac.id

Abstrak

Tujuan dari penelitian ini adalah (1) Mengetahui distribusi artikel yang berkaitan dengan penggunaan TVA sebagai media pada publikasi selama 5 tahun terakhir; (2) Mengetahui distribusi bahasa yang digunakan dalam penulisan publikasi TVA; (3) Mengetahui jumlah publikasi ilmiah TVA sebagai Physics media research; (4) Mengetahui korelasi antara subjek yang digunakan dalam penelitian TVA. Metode yang digunakan dalam penelitian ini adalah analisis bibliometrik yang dapat membantu para peneliti dalam mempelajari isi bibliografi, menganalisis korelasi objek dari metadata Scopus dalam 5 tahun terakhir, yaitu 2016 – 2020. Dari hasil penelusuran di Scopus dengan kata kunci TVA diperoleh sebanyak 24.495 dokumen. Ada tiga kelompok dominan, yaitu Study, State, dan object. TVA berkaitan dengan studi, model penelitian dan pembelajaran Fisika, terkait pelacakan suatu objek atau patokan, terkait dengan kegiatan atau kegiatan masyarakat di suatu negara melalui prinsip Fisika pada TVA.

Kata kunci: *TVA, Tracker Video Analysis, Physics, Bibliometrik*

Abstract

The purpose of this research is (1) To identify the distribution of articles related to the use of TVA as a medium in publications over the past 5 years; (2) To identify the distribution of languages used in the writing of TVA publications; (3) To identify the number of TVA scientific publications as Physics media research; (4) To identify the correlation between subjects used in TVA. The method used in this research is bibliometric analysis that can help researchers in researching the contents of bibliographies, analyzing the correlation of objects from Scopus metadata in the last 5 years, namely 2016 - 2020. From the search results on Scopus with the keyword TVA obtained as many as 24,495 documents. There are three dominant groups, namely Study, State, and Object. TVA deals with studies, research models and learning, related to tracking an object or benchmark, related to community activities or activities in a country.

Keywords: TVA, Tracker Video Analysis, Physics, Bibliometric

INTRODUCTION

Physics has become one of the sciences that explores natural processes that occur in daily life. Experimental observations and quantitative measurements are the foundations of physics. The rules underlying a phenomenon are expressed in a mathematical language that serves as a bridge between theory and experimental data (Syaepudin, 2018). Physics as a process implies that one of a scientist's traits is the ability to solve issues using a logically acceptable scientific technique. Experiments can be used to overcome these challenges (Khotijah et al., 2019). In everyday life, there are several physical events that may be witnessed. Misconceptions are caused by a variety of factors, including preconceptions, talents, developmental stages, hobbies, and methods of thinking. (Nirmayanti et al., 2018). Meanwhile, Suparno (2013) in Syahrul & Setyarsih, (2015), Preconceptions are physical concepts developed by students themselves through informal learning to provide meaning to common occurrences.

Video analysis utilizing the Tracker application aids in boosting learning, making natural sciences more fascinating and making it simpler to evaluate natural phenomena Open Source Physics (OSP) (Brown & Cox, 2009). Topics connected to kinematics and motion phenomena in general are best suited for examining natural occurrences of physics utilizing Track Video Analysis (TVA) software (Fitriyanto & Sucahyo, 2016).

It is strongly advised to stay at home during this pandemic time in order to reduce pandemic infection. Practice not needing to go to the lab to perform experiments by using this program. As a result, the TVA is capable of facilitating practice in performing experiments, particularly in the discipline of Physics. Although the value of mastery of materials for the analysis of motion video objects with the Tracker tool is still quite low, the training of video analysis of object movements using an effective tracker to increase the mastery of MGMP Physics teachers in Agam regency for video analysis materials and tracker modeling tools is still quite low (Asrizal et al., 2018).

Tracker is a piece of technology that is built on the Open Source Java Framework. Douglas Brown worked on the Java OSP project to create this software application. This program is available for free download. This software's primary job is to model and analyze videos (Fitriyanto & Sucahyo, 2016). The TVA may be obtained for free from the open source physics website. Many Physics Education writers have employed the tracker video analysis. The advantage of employing tracker video analysis is that the results are compatible with real-world data of gravitational acceleration on the earth's surface (Muliyati et al., 2020). The guard tracker demonstrates how an experiment may be carried out quickly and cheaply, allowing students to investigate scientific phenomena quantitatively. According to Aravind (2016), Track software is a video analysis application that is specifically utilized in physics learning. This program can assist students in analyzing commonplace motion occurrences captured on film. Track Video Analysis (TVA) also enables pupils to comprehend the motion phenomena that surround them. (Aravind, 2016). It is predicted that the use of technology would increase the quality of learning, one of which is experimental activities.

TVA makes it simple for observers to do research on natural occurrences, namely acceleration, force, gravitational field, energy conversion, and conversion. According to his research, the application of Physics learning with analytical techniques utilizing TVA video at one of Indonesia's high schools is extremely excellent and enhances students' capacity to observe, measure, plan experiments, evaluate data, and communicate (Wicaksono et al., 2017). Trackers give students the opportunity to practice understanding in analyzing video and kinematic data processing, identifying relationships between physical quantities and realizing a learning model has detailed similarities between experiments and theory (Aguilar-Marín et al., 2018).

Bibliometrics, which is a collection of methodologies for researching or measuring texts and information, has become a basic instrument of science policy and research administration in recent decades. Academic institutions, in particular, are increasingly relying on citation analysis to make recruiting, promotion, tenure, and financing choices (Weingart, 2005). Bibliometric research have been widely used in the scientific sector, focusing on various types of information such as authors, titles, subjects, citations, and so on (Natakusumah, 2016). Bibliometrics is derived from the words biblio or bibliography and metrics, which may be used to measure or research books and literature by using mathematical and statistical methodologies (Royani & Idhani, 2018).

According to earlier studies, bibliometrics, also referred as scientometrics, has numerous meanings. Bibliometrics is a research approach for evaluating many pre-existing literacies (Ellegaard & Wallin, 2015). Any use of bibliometrics in research might demonstrate that a considerable amount of research production is not published in the major radiology journal in the United States within a short period of time (Rosenkrantz et al., 2019). Filtering using bibliometric approaches will assist both the scientific community and the general public since it can help put the publishing metada into a map or visualization that readers can comprehend, such as showing keywords to discover research topics (clusters) in a certain subject (Tanudjaja & Kow, 2018). Bibliometrics have been used to examine trends, which include research areas, document sources, publishing outputs, document sources, language sources, country and institution distribution, top authors, number of citations, and author keywords (Philosophy & Suprapto, 2021).

According to Sulistyo-basuki (2003), the purpose of biliometrics is to describe the textual communication process as well as the nature and direction of growth through descriptive calculation and analysis as a communication phase (Irianti, 2016). Thus, the purpose of this research is to (1) determine the distribution of articles related to the use of TVA as a device loaded over the last 5 years; (2) determine the distribution of languages used in TVA publications; (3) determine the number of tva scientific publications as a medium of physics; and (4) determine the correlation between subjects used on TVA.

RESEARCH METHOD

The approach employed in this research is bibliometric analysis, which may assist researchers in researching the contents of bibliographies by assessing

the correlation of items from Scopus metadata during the previous five years, from 2016 to 2020. Scopus is accessed on Google surf computers to collect data. Determine the keywords for the data search, and then do a search using the following terms: *track AND video AND analysis AND (LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2018) OR LIMIT-TO (PUBYEAR , 2017) OR LIMIT-TO (PUBYEAR , 2016)).* Then, the

download of the necessary metadata such as the number of articles, author name, agency name, number of article pages, publisher's journal, issuing country in the form of RIS and xls. Then, RIS data is processed using vosviewer to find out the distribution map of authors and subjects related to TVA. As well as an analysis of the response of vosviewer software. For metadata on xls, analysis is performed using Microsoft Excel.
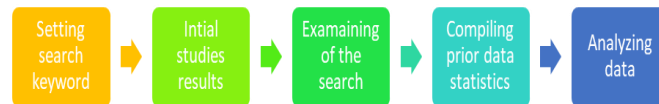

Figure 1. Research Flowchart
(Suprapto, Nadi; Prahani, Binar Kurnia; and Deta, Utama Alan. 2021)(Philosophy & Suprapto, 2021)

RESULTS AND DISCUSSIONS

From the search results on Scopus with the keyword TVA with a time range of 2016 - 2020 obtained as many as 24,495 documents. Of the 24,495 documents that can be downloaded bibliometrically, only 2168 are the top documents. Based on Vosviewer's analysis with cluster analysis, the minimum number of occurences of term is

set at 10 out of 46530 terms, 860 which meet the threshold. Of the 860 terms, the relevance value is calculated. Based on this value, the most relevant will be selected by Vosviewer. Vosviewer software is automatically set to 60% of the most relevant terms, where the number of selected terms is 516. Overall, of the 176 clusters there are three dominant clusters, namely Study, State, and object. This is indicated in Figure 2.
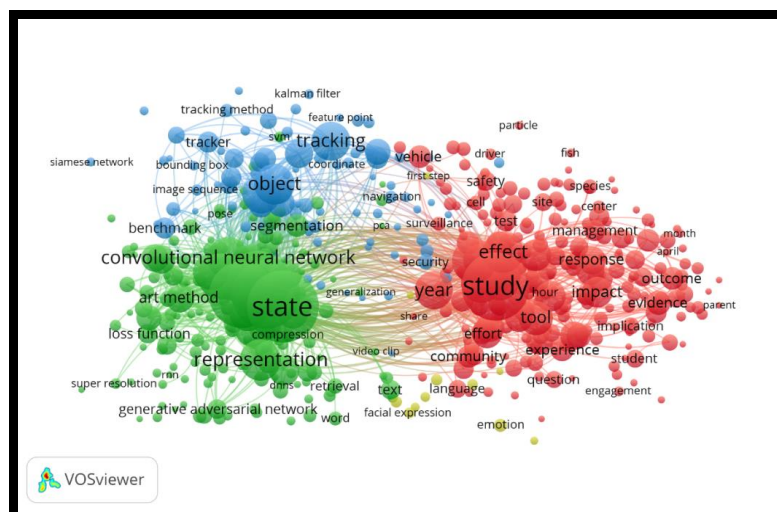
Figure 2. Network Visualization of TVA Research

Based on Figure 2, there are 3 main clusters in bibliometric mapping related to TVA, namely states with green node colors (green), study with red node colors (red) and tracking and objects with blue node colors. If the study subject takes the study-tool subject as a focus to

see its relevance with other subjects, then the subjects of tracking, oject, benchmark and state that appear most prominent, while representation is behind the state vaguely. It is described as in Figure 3.

Figure 3. Network Visualization TVA Fcus on 'Study' Subject

Based on Figure 3, in more detail, it is described that the study, subject and tool are closely related to tracking. Then, tracking itself contains a link to the object and benchmark, then from the three dominant subjects of the blue node is close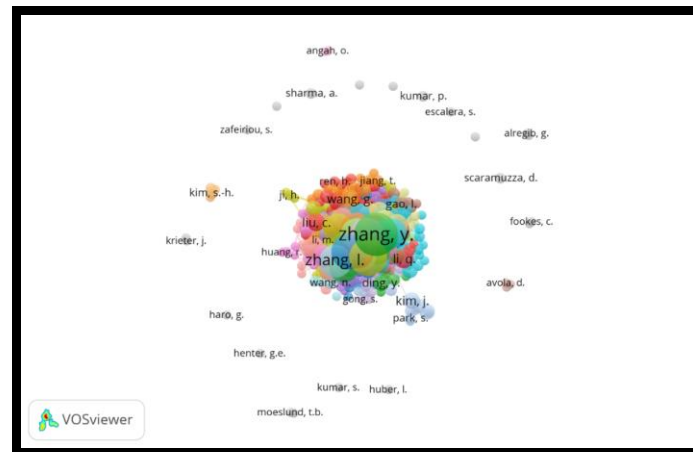ly related to the state subject. Thus, in Figure 3 it can be described that TVA studies in the field of learning tools are used as one of the media to detect an object and benchmark on a state or representation of an observed state. From Figure 3 it can be analyzed that, TVA related to study both research and learning models, related to tracking an object or a benchmark.

The usage of TVA as one of the physics learning medium in high school may considerably increase students' abilities to achieve data, tables, and graphs, particularly on the content of basic harmonic movement based on guided inquiries (Raflesiana et al., 2019). TVA may be utilized as a thermal expansion detector in a research as well as a detection technique in motion materials. TVA is efficiently employed in non-laboratory experiments in students on the kinematics of translational motion, vibration, and also rotation. (Rizki et al., 2021). Other research conduct by Fadholi et al., (2018) Stated that the understanding of physics concepts through analytical activities assisted by TVA Software deserves to be used with excellent predicate. The use of TVA as one of the research media for the development of

experimental tools to find the value of the coefficient of thermal expansion shows results that have a high degree of accuracy and precision (Yogaswara & Latief, 2018). Meanwhile, Khansari et al., (2008), research showed that crowded motion detection can use algortima to crowded motion based on pixel features. In other research by Yunwei & Shiwei, (2019) develop video analysis technology in a badminton game to improve the quality of badminton training. Based on research, the magnitude of the acceleration of free fall motion objects analyzed

using TVA, detailed interview is the same as the acceleration of gravity in theory (Ristiawan, 2018). Then, in its application as a benchmark in learning tools¸ based on research by Astro & Ngapa, (2020), Using TVA as a tool to measure the value of the head used to determine the analysis of the minimum power potential that ngamba Mbu'u waterfall is capable of producing.

After processing data on subjects related to TVA. Furthermore, it is analyzed about the distribution of authors in documents related to TVA. Based on metadata there are 6590 authors, then on Vosviewer set to a minimum number of doucments of authors as many as 3 documents. So that 356 document thresholds were found.

Figure 4. Author(s) Network Visualization TVA

Based on Figure 4, the green node (green) is at the top of the order with author Zhang Y. then it is carried with li's yellow node, Y. Related to community activities or activities in a country there is research such as conference paper by Wang et al., (2020) dengan judul Foreign Body Intrusion Detection Algorithm for Track Surveillance Systems in Smart Cities.

After analyzing the mapping of subject and author visualization using vosviewer, the reviewer used the help of Microsoft Excel to find out several aspects such as the

distribution of languages used by the Author, the type of document to the number of documents uploaded by the Author on Scopus. Based on analysis using metadata in Microsoft Excel, the distribution of languages used by authors in documents related to TVA is as in Figure 5.
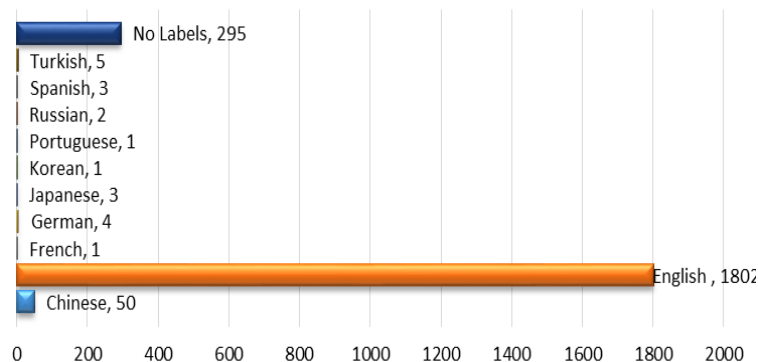
Figure 5. Distribution of Languages Used

Based on Figure 5, there are 10 variations of the language used by the authors, namely, Turkish, Spanish, Russian, Portuguese, Korean, Japanese, German, French, English and the rest are not listed. Of the several variations of the language, the most widely used is English with 1802 documents. In addition, 295 of the 2169 documents are not known in the metadata language. After English, the most widely spoken language by authors in the second order is Chinese.

Referring to Figure 4, mapping can be done using Microsoft Excel against the number of documents in each

top author seen in vosviewer analysis. From the results of the mapping, it can be known the number of documents uploaded by each author, namely, Zhang Y, has the most prominent points because it has 9 documents from a minimum limit of 3 documents. Then followed by Wang H who has 8 documents, then Zhang Z with 6 documents and Wang Z and Li Y with 5 documents. It is described by Figure 6.
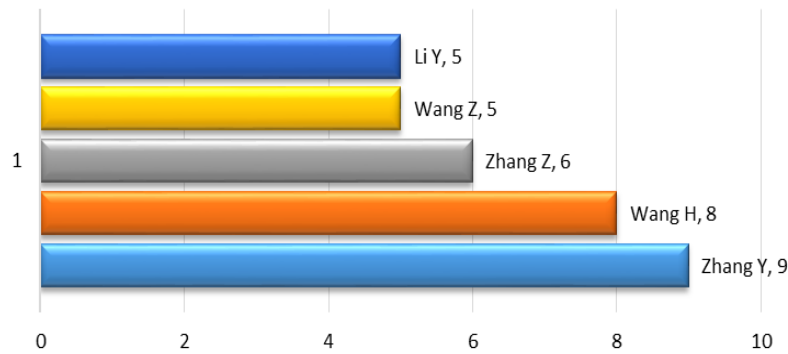
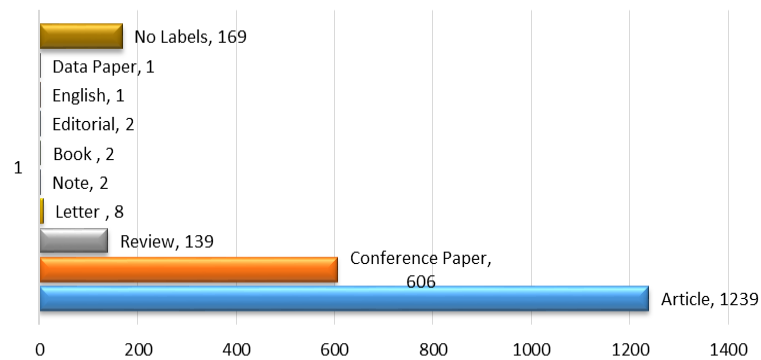**Figure 6.** Every Top Author Document

Figure 7. Document Type Distribution

Of the 24,495 documents uploaded on Scopus and 2168 documents that can be downloaded in detail, it can be known the distribution of variants or types of documents uploaded. This is described by Figure 9. Where, the article has the most number with a total of 1239 documents, then conference papers as many as 606, reviews as many as 139, other documents as many as 16 and documents are not known or listed type as many as 169.

Based on the findings in this research, it is possible to further utilize TVA as one of the learning media innovations in Physics subjects from elementary school to university level. If the resources are met, then the use of TVA in learning is considered to be a fun Physics learning.

CONCLUSION

Search results on Scopus with the keyword TVA with a time range of 2016 - 2020 obtained as many as 24,495 documents. Of the 24,495 documents that can be downloaded bibliometrically, only 2168 are the top documents. Overall, of the 176 clusters there are three dominant clusters, namely Study, State, and Object.

TVA related to study both research and learning models, related to tracking an object or a benchmark, related to community activities or activities in a country.

For example, such as conference paper by Wang X., et al. There are 10 languages spoken by authors, but the most widely spoken are English and Chinese. Zhang Y, has the most prominent points for having 9 documents out of a minimum limit of 3 documents. While the most widely used type of document is in the form of articles with a total of 1239 documents.

Based on the findings in this research, it is possible to further utilize TVA as one of the learning media innovations in Physics subjects from elementary school to university level. If the resources are met, then the use of TVA in learning is considered to be a fun Physics learning.

Based on this research, the research could not observe the trend every year, so in the next research is expected to observe trends every year on the use of TVA.

REFERENCES

Aguilar-Marín, P., Chavez-Bacilio, M., & Jáuregui-Rosas, S. (2018). Using analog instruments in TVA video-based experiments to understand the phenomena of electricity and magnetism in physics education. *European Journal of Physics*, *39*(3), 35204. https://doi.org/10.1088/1361-6404/aaa8f8

Aravind, V. (2016). Video and multimedia in physics education. *Engineering and Science Communication*.

Asrizal, A., Yohandri, Y., & Kamus, Z. (2018). Studi hasil pelatihan analisis video dan tool pemodelan tracker pada guru mgmp fisika kabupaten agam. *Jurnal Eksakta Pendidikan (Jep)*, *2*(1), 41. https://doi.org/10.24036/jep/vol2-iss1/84

Astro, R. B., & Ngapa, Y. D. (2020). Analisis Potensi air terjun ngamba mbu ' u kabupaten ende sebagai pembangkit listrik tenaga mikrohidro. *Jurnal Pendidikan Fisika Tadulako Online (JPFT)*, *8*(2), 79–83.

Brown, D., & Cox, A. J. (2009). Innovative uses of video analysis. *The Physics Teacher*, *47*(3), 145–150. https://doi.org/10.1119/1.3081296

Ellegaard, O., & Wallin, J. A. (2015). The bibliometric analysis of scholarly production: How great is the impact? *Scientometrics*, *105*(3), 1809–1831. https://doi.org/10.1007/s11192-015-1645-z

Fadholi, L., Harijanto, A., & Lesmono, A. D. (2018). Analisis video kejadian fisika dengan software tracker sebagai rancangan bahan ajar momentum dan impuls untuk meningkatkan kemampuan berfikir kritis siswa sma kelas x. *Jurnal Pembelajaran Fisika*, *7*(3), 263–270. https://jurnal.unej.ac.id/index.php/JPF/article/view/8598/5856

Fitriyanto, I., & Sucahyo, I. (2016). Penerapan Software tracker video analyzer pada praktikum kinematika gerak. *Jurnal Inovasi Pendidikan Fisika (JIPF)*, *05*(03), 92–97.

Irianti, P. (2016). Studi bibliometri media komunikasi ilmiah berkala ilmu perpustakaan dan informasi. *JURNAL IPTEKKOM : Jurnal Ilmu Pengetahuan & Teknologi Informasi*, *18*(1), 69. https://doi.org/10.33164/iptekkom.18.1.2016.69-80

Khansari, M., Rabiee, H. R., Asadi, M., & Ghanbari, M. (2008). Object tracking in crowded video scenes based on the undecimated wavelet features and texture analysis. *Eurasip Journal on Advances in Signal Processing*, *2008*. https://doi.org/10.1155/2008/243534

Khotijah, K., Arsini, A., & Anggita, S. R. (2019). Pengembangan Praktikum fisika materi hukum kekekalan momentum menggunakan aplikasi video tracker. *Physics Education Research Journal*, *1*(1), 37. https://doi.org/10.21580/perj.2019.1.1.3961

Muliyati, D., Septiningrum, A. D., Ambarwulan, D., & Astra, I. M. (2020). The development of guided inquiry student worksheet using tva for kinematics motion topics. *Journal of Physics: Conference Series*, *1491*(1). https://doi.org/10.1088/1742-6596/1491/1/012062

Natakusumah, E. K. (2016). Bibliometric analysis of the inkom journal (analisis bibliometrik jurnal inkom). *Jurnal Dokumentasi Dan Informasi*, *36*(1), 1. https://doi.org/10.14203/j.baca.v36i1.199

Nirmayanti, Mansyur, J., & Saehana, S. (2018). Konsepsi siswa sma tentang percepatan. *Jurnal Pendidikan Fisika Tadulako (JPFT)*, *6*(4), 7–18.

Philosophy, L., & Suprapto, N. (2021). *DigitalCommons @ University of Nebraska - Lincoln Research Trend on Ethnoscience through Bibliometric Analysis (2011-2020) and The Contribution of Indonesia.*

Raflesiana, V., Herlina, K., & Wahyudi, I. (2019). Pengaruh penggunaan tracker pada pembelajaran gerak harmonik sederhana berbasis inkuiri terbimbing terhadap keterampilan interpretasi grafik siswa. *Gravity : Jurnal Ilmiah Penelitian Dan Pembelajaran Fisika*, *5*(1), 1–12. https://doi.org/10.30870/gravity.v5i1.5207

Ristiawan, A. (2018). Analisis gerak jatuh bebas dengan metode video based laboratory (vbl) menggunakan software tracker. *Journal of Teaching and Learning Physics*, *3*(2), 26–30. https://doi.org/10.15575/jotalp.v3i2.6556

Rizki, I. A., Citra, N. F., Saphira, H. V., Setyarsih, W., & Putri, N. P. (2021). Eksperimen dan respon mahasiswa terhadap praktikum fisika non-laboratorium menggunakan aplikasi tracker video analysis untuk percobaan kinematika gerak. *Journal of Teaching and Learning Physics*, *2*, 77–89.

Rosenkrantz, A. B., Chung, R., & Duszak, R. (2019). Uncited Research articles in popular united states general radiology journals. *Academic Radiology*, *26*(2), 282–285. https://doi.org/10.1016/j.acra.2018.04.011

Royani, Y., & Idhani, D. (2018). Analisis bibliometrik jurnal marine research in indonesia 1. *Marine Research in Indonesia*, *25*(4), 63–68.

Syaepudin, M. R. (2018). Menganalisis sudut pendulum pada bidang miring menggunakan software tracker video. *Journal of Teaching and Learning Physics*, *3*(2), 14–20. https://doi.org/10.15575/jotalp.v3i2.6553

Syahrul, D. A., & Setyarsih, W. (2015). Identifikasi Miskonsepsi dan penyebab miskonsepsi siswa dengan three-tier diagnostic test pada materi dinamika rotasi. *Jurnal Inovasi Pendidikan Fisika (JIPF)*, *04*(03), 67–70.

https://jurnalmahasiswa.unesa.ac.id/index.php/inovasi-pendidikan-fisika/article/view/13305

Tanudjaja, I., & Kow, G. Y. (2018). Exploring bibliometric mapping in nus using bibexcel and vosviewer. *IFLA WLIC Kuala Lumpur*, 1–9. *2020*, 5209–5213. https://doi.org/10.1109/CAC51589.2020.9326684

Weingart, P. (2005). Impact of bibliometrics upon the science system: Inadvertent consequences? *Scientometrics*, *62*(1), 117–131. https://doi.org/10.1007/s11192-005-0007-7

Wicaksono, I., Wasis, & Madlazim. (2017). The effectiveness of virtual science teaching model (VS-TM) to improve student's scientific creativity and concept mastery on senior high school physics subject. *Journal of Baltic Science Education*, *16*(4), 549–561. https://doi.org/10.33225/jbse/17.16.549

http://library.ifla.org/2190/1/163-tanudjaja-en.pdf

Wang, X., Chen, F. E., & Liang, X. M. (2020). Foreign body intrusion detection algorithm for track surveillance systems in smart cities. *Proceedings - 2020 Chinese Automation Congress, CAC*

Yogaswara, Y., & Latief, F. D. E. (2018). The Development of experimental sets for measuring linear thermal expansion coefficient of metal using digital video-based single slit diffraction method. *Jurnal Penelitian & Pengembangan Pendidikan Fisika*, *4*(2), 141–152. https://doi.org/10.21009/1.04211

Yunwei, L. I., & Shiwei, J. (2019). Video analysis technology and its application in badminton sports training. *Journal of Physics: Conference Series*, *1213*(2). https://doi.org/10.1088/1742-6596/1213/2/022009