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Research Article

Integration of Demonstrative Teaching and Supporting Theories of Fluid Mechanics: A Literature Review

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ABSTRACT

This review will give emphasis to the concept of demonstrative teaching to better improve the learning process of students in fluid mechanics. This paper is going to tackle the possible techniques students do to gain a better understanding of the concepts of fluid mechanics. With that, this review will also look at the impact of learning towards the students based on the number of demonstrations that they are making. This is where we will find out if there is a significant difference in the results with respect to the number of demonstrations performed. This paper will also discuss the most appropriate approach a beginner may take in handling a fluid mechanics class.

Keywords: *demonstrative teaching, teaching fluid mechanics, teaching physics*

Background

We chose to do this study while we were enrolled in a fluid mechanics class. We observed that students seem to struggle learning fluid mechanics and the complex theories that go with it. Fully aware that there are pre existing studies that are connected to the said topic, we decided to create a systematic review of the topic

Introduction

Rationale

It is not a mystery why students have difficulty learning fluid mechanics. Mainly, this is because of the considerable number of abstract

concepts embedded in the subject, just like Bernoulli's principle, dynamic pressure, and such. (Li, X, and Zhou, A.J. 2022). Fluid mechanics can be extremely perplexing for the average learner. Students may find it challenging to overcome misconceptions like these. Multiple sorts of exposure to each topic, such as lectures, problem-solving, and reading assignments, can be beneficial, but demonstrations provide an additional type of exposure that is not only informative and visual but also pleasant. (Garrison, L., and Garrison T., 2015). With that, this review aims to get a better view of the learning efficiency through demo teaching.

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Statement of the Problem

The main goal of this review is to comprehend the demonstrative teaching method of learning in fluid mechanics. With that, this aims to answer the following questions:

- What are the techniques used for students to better understand fluid mechanics?
- What are the impacts on the learning process based on the number of demonstrations conducted?
- What is the most appropriate approach for a beginner to take in conducting fluid mechanics classes?

Methods

Eligibility Criteria

- The publication date must be within the years 2010 up to the present date.
- Articles must contain content relevant to demonstrative teaching.
- Articles must contain content relevant to teaching fluid mechanics.

Information Sources

A systematic approach has been applied in the study to search for articles on scholarly websites with the use of Harzing's publish or perish software. Google scholar and Crossref databases were utilized to find articles that are relevant to our study. The key terms used are "demonstrative teaching in physics" and "teaching fluid mechanics" to look for articles.

Research Design

The researchers utilized PRISMA's flow chart in the selection of relevant studies relating to the topic. PRISMA will give a more organized and transparent flow of the studies being used in the paper. A total of forty-four related studies has been used as samples for data extractions. These samples have already gone through primary filters to ensure that they would have somewhat relevant data to be given.

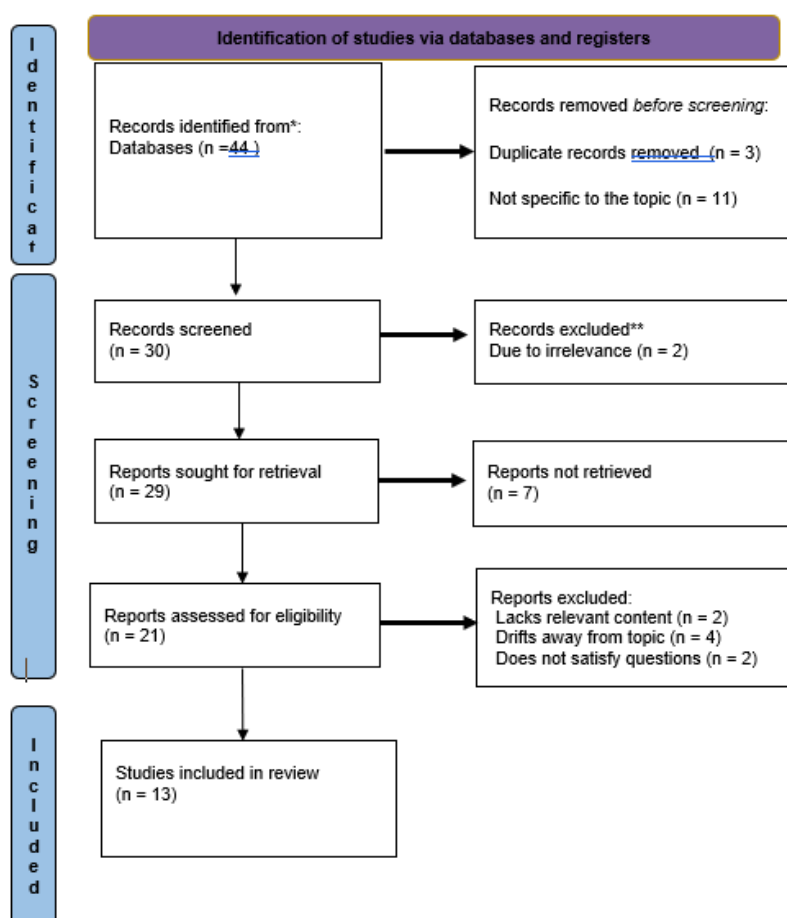


Figure 1

Review of Related Literature

According to Li X. (2022), the most likely reason is the vast number of abstract ideas involved, such as pressure losses, Bernoulli's equation, and Reynolds number. Students are also unable to connect mathematics to physical facts. Introduce computer and multimedia tools to augment the learning process so that students may experience the "moving" fluid. For the average learner, fluid mechanics can be particularly perplexing. Most pupils, for example, will tell you that as velocity rises, so does pressure. Students may find it difficult to overcome misconceptions like these. Multiple types of exposure to each topic, such as lectures, problem solving, and reading assignments, can be beneficial, but demonstrations provide an additional type of exposure that is not only informative and visual, but also enjoyable.

During a lecture, demonstrations can help students pay attention and get a "feel" for the topic, allowing them to believe the notion they're learning (Garrison, L. A. 2015).

Teaching skills are a set of abilities that a teacher must possess in order to comprehend the challenges that students will confront during the teaching and learning process and to prepare the information to be taught (Apling, M. 2019). Experimentation is a crucial aspect of a fluid mechanics course because of the subject's nature. Laboratory practicals are frequently included as part of the scheduled delivery of physical concepts courses. They let students see the actual manifestations of nature. They explain concepts and compare theoretical models to real-world results, and they can accommodate different learning styles. These justifications are relevant to fluid mechanics courses. The nature of the subject often involves the understanding of qualitative or counterintuitive concepts that are best understood through a tactile experience (Garrard, et.al. 2020).

According to Corcoles et al. (2019), 88% of students found that hands-on activities are better for learning fluid mechanics, but this type of method of teaching will require more time, which 80% of the students were concerned about. Students learn more effectively if they predict what should happen first, then observe

physical phenomena before diving into governing equations and rigorous math. Students can comprehend mathematical solutions, identify errors in their solutions, and comprehend the significance of the results as a result of their conceptual understanding (Shih, A., 2017). Students learn through practical situations that pose challenges for them to solve. During the learning process, students exchange opinions with colleagues in order to build on the idea (Soares, F., 2015).

It must be presumed that the instructor's teaching tactics do not correspond to the majority of the students' learning styles, resulting in a negative atmosphere of motivation and absorption for the teaching-learning process. In general, the type of student that enrolls in Fluid Mechanics knows very little about the subject and is more interested in core courses than multidisciplinary knowledge. There's also the fact that the subject is taught alongside or even after other fundamental disciplines.

To summarize, fluid mechanics students can be characterized by some of the following characteristics:

- a. A lack of motivation that comes from not knowing anything about its content.
- b. The obligation to take the course, since it is a common core subject for the degree,
- c. A lack of interest that results from not seeing its application or usefulness in terms of their major or specialty.
- d. A lack of satisfaction results from taking the course and not reaching the established expectations.

(Montero, P. J. et. al., 2015).

Abstract theories and sophisticated mathematical formulas are used to derive the majority of concepts and laws in popular undergraduate physics textbooks. It is extremely difficult for students to master and comprehend the physical sciences. concepts and principles in a short period of time using sophisticated mathematical calculations The advantage of multimedia courseware in the physical classroom as a classroom teaching tool is dynamic simulation, which can imitate students' interest is piqued by visual experiments using unique analog animation and good physical settings. As a

result, students will be able to form distinct impressions, acquire and understand physical concepts and principles more quickly (Jianhua, S., 2012). Experimental teaching is a key connection in developing students' abilities to practice and innovate. The open modular experimental teaching mode is a successful method of developing innovative ability (Zheng, et al., 2013).

A series of classroom demo experiments are being built utilizing simple devices such as water tanks, pressure sensors, and timers to make the teaching and learning process more efficient. Hydraulic pressure, a Venturi tube, a free jet, and big and minor pressure losses are among the demonstration tests. In this article, it discusses the specifics of these experiments, as well as how to connect them to the fundamental theory. By introducing these simple in-class demo experiments, there are some learning outcomes that the students are expected to have. It is also seen that these practices are helpful for students to understand and grasp the knowledge that they should acquire so as to maintain their interest in the topic being presented (Ang, Li, & Zhou, 2022).

Over 30 demonstrations and videos that can be used to improve students' comprehension of fluid mechanics and pique their interest in the different areas related to the said discipline were presented. All of the topics covered in a normal fluid mechanics course, including hydrostatics, viscosity, control volume analysis, similarity, Navier-Stokes solutions, pipe flow, minor losses, and external flow, include demonstrations and videos. The majority of the demonstrations are low-cost and were created by the writers and their students. The paper goes over each of the demonstrations and films, how they are integrated into the lesson, and how to manufacture or obtain the demo equipment. Demonstrations during a lecture period can increase attentiveness and give the students a "feel" for the topic, helping them actually believe the concept that they are learning. These demonstrations also provide an excellent memory point for the students to use as their reference when they need to use these particular concepts to solve problems (Garri-son & Garrison, 2015).

Results

Study Selection

There were a total of forty-four studies that had been chosen that seemed to be relevant to the study. Of the total studies that were chosen, only thirteen passed the screening based on the eligibility criteria. There were some studies that managed to pass through screening, but were later on removed due to these reasons:

- a. Duplicated file
- b. Could not be accessed
- c. Drifts away from the topic
- d. Similar idea has already been included

Data Collection

The collection of data was aided by Harzing's Publish or Perish software. Once relevant studies has been chosen and have passed all of the filters used for the inclusion criteria, we extracted data based on their abstract and review of related literature. Some studies were straight forward in giving their collected data, but there were some studies that did not focus on the specific aspect that we were looking for, but they did have relevant information that we required. We managed to collect broad ideas, but we managed to narrow it down to give specific answers to the objectives of this review.

Data Analysis

The data was obtained from the related literature of this study about the integration of demonstrative teaching and supporting theories of fluid mechanics. It presents the concepts in relationship with the teaching demonstrations of certain principles and with the effect they can have on the acquisition of knowledge of students in the lessons of that particular field. The data pertains to the techniques used by students to better understand fluid mechanics; the impacts on the learning process based on the number of demonstrations conducted; and the relationship between the complexity and quality of a topic.

Risk of Bias

In general, the study that was used may contain very little bias, this is because of the broad observations that were stated in the studies used. Majority of the observations that

were made for the data of the studies used engineering students, this factor may pose bias, as it does not utilize students that also take up fluid mechanics.

Certainty of Evidence

The studies that were used for this review gave similar outcomes, thus we can safely say that the results are reliable. The studies were also taken from credible sources. The results also managed to clearly answer the stated problems of the paper.

Discussions

a. What are the techniques used for students to better understand fluid mechanics?

Students seemed to prefer having hands-on activities as an alternative to regular classroom discussions. Studies have shown that conducting hands-on activities stimulates the learning of students; it also lets the students remain interested in the topic for a longer period of time (Garrison, L. 2015). Fluid mechanics is one of the oldest branches of physics, and physics deals with its concepts in terms of mathematics. Students tend to have a harder time understanding the concepts of physics if they are only given in terms of math. By using real world problems, students are able to grasp the concepts faster since they can see how they apply (Zheng, B. 2013).

b. What are the impacts on the learning process based on the number of demonstrations conducted?

As Fluid Mechanics and its subtopics are associated with such certain applications and with the demonstrations they include, it will greatly help students' learning process (Soares, F. 2015). They will practice and improve their knowledge; with their interest piqued by these demonstrations, it will be easy for them to understand and desire to explore more such fields. It simply implies that with a greater number of demonstrations, there would be a lot of ways as well to make the students effectively and efficiently grasp the knowledge they should learn from a certain lesson in fluid mechanics

(Corcoles, J. et.al. 2019). During a lecture, demonstrations can help students pay attention and get a "feel" for the topic, allowing them to believe the notion they're learning. These demos also serve as a great memory aid for students when they need to use these concepts to solve problems. Demonstrations surely assist students in becoming more interested in the Fluid Mechanics subject. According to the studies being done, the majority of students said the demonstrations helped them take a greater interest in class discussions and understand the concept of fluid mechanics.

c. What is the most appropriate approach for a beginner to take in conducting fluid mechanics classes?

Other recent experiences that have successfully increased student motivation have been based on games and atypical experiments (Absi, Nalpas, Dufour, Huet, Bennacer & Absi, 2011) and on touch screen devices used for dynamic learning experiences (Kumar, Ramana, Afrin, Ortega, Agarwal & Udoewa, 2013). Students are pushed into the wide unknown when the subject of Fluid Mechanics is being encountered. In relation to this discipline, it has learning activities that are designed for students' better understanding and learning. It would have a self-assessment at the beginning of the course that would be completed individually by the students, and this would be done online. This online questionnaire has the advantage of allowing students or beginners to assess their own knowledge of the topic matter and the course they will be taking. The goal is to help students know where to find their starting point in relation to the course. Differential education was necessary since students had different specialties. Each group might receive instruction, making the course more appealing and valuable to each profile. In general, along with lectures, the best approach is to have activities to conduct, particularly demonstrations. The students' specialties should also be considered in order to impart the concepts of Fluid Mechanics well; to make students

understand and grasp the learning that they should acquire.

References

- Apling, M., Haryani, S., & wati, E. (2019). *The analysis of microteaching in improving teaching skill of pre-service physics teachers*. Journal of Innovative Science Education. Retrieved April 11, 2022, from <https://journal.unnes.ac.id/sju/index.php/jise/article/view/31167>
- Corcoles, Juan Ignacio, & Martínez-Romero, Angel (2019). INTRODUCTION TO THE METHOD OF PROBLEM BASED LEARNING FOR TEACHING FLUID MECHANICS. INTED2019 Proceedings, ISSN 2340-1079, IATED, <<https://doi.org/10.21125/inted.2019.0699>>
- Gamez-Montero, P. J., Raush, G., Domenech, L., Castilla, R., Garcia-Vilchez, M., Moreno, H., & Carbo, A. (2015). Methodology for developing teaching activities and materials for use in fluid mechanics courses in undergraduate engineering programs. *Journal of Technology and Science Education*, 5(1). <https://doi.org/10.3926/jotse.135>
- Garrard, Andrew, Bangert, Krys, & Beck, Stephen (2020). Large-Scale, Multidisciplinary Laboratory Teaching of Fluid Mechanics. *Fluids*, 5(4), 206, ISSN 2311-5521, MDPI AG, <<https://doi.org/10.3390/fluids5040206>>
- Garrison, L. A., & Garrison, T. J. (2015). *A demo every day: Bringing Fluid Mechanics to Life*. A Demo Every Day: Bringing Fluid Mechanics to Life. Retrieved April 11, 2022, from <https://www.asee.org/public/conferences/56/papers/11842/download>
- Jian-hua, S., & hong, L. (2012). Explore the effective use of multimedia technology in college physics teaching. *Energy Procedia*, 17, 1897–1900. <https://doi.org/10.1016/j.egypro.2012.02.329>
- Li, X., & Zhou, A. J. (2022, March), INCORPORATING SIMPLE CLASSROOM DEMO EXPERIMENTS TO ENHANCE TEACHING OF FLUID MECHANICS Paper presented at 2010 GSW, unknown. 10.18260/1-2-620-39013
- Soares, F. (2015). *Interpreting students' perceptions in fluid mechanics learning outcomes*. Research Gate. Retrieved May 20, 2022, from https://www.researchgate.net/publication/283835107-Interpreting_Students%27_Perceptions_in_Fluid_Mechanics_Learning_Outcomes
- Zheng, B., Liu, Y. Q., Liu, R. X., Meng, J., & Mao, M. M. (2013). Open experimental teaching in Fluid Mechanics. *Applied Mechanics and Materials*, 397-400, 2735–2738. <https://doi.org/10.4028/www.scientific.net/amm.397-400.273>