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Student Performance and Attitudes in Undergraduate Food Science and Technology Courses with Flipped Labs

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Abstract

The food industry needs a lot of well-trained professionals to produce healthier food products, improve manufacturing processes, and guarantee food safety and security as consumer demand for healthy and convenient food products grows. Graduates in food science and technology must be able to solve problems, think critically, and apply newly acquired knowledge in order for them to effectively address these requirements. Expository or confirmatory practical laboratories, in which the research questions and procedures are already established, are frequently used in undergraduate food science and technology courses. It is generally accepted that expository laboratory practicals provide students with opportunities to learn practical, hands-on skills, interpret data, reinforce theoretical concepts, draw conclusions, and pique their interest in the topic at hand. In light of today's industry 4.0, also known as the fourth industrial revolution, which is characterized by automation and big data, it is essential for students to develop and practice these skills.

Keywords: Food Science • Graduates • Flipped Labs

Introduction

According to Gregory and Di Trapani, "students' ability to be adequately prepared both conceptually and procedurally is essential" for any long-term benefit to be derived from practical laboratory classes. The lack of student preparation for laboratory classes is a common issue with undergraduate laboratory work. College understudies seldom read from course books or lab guidelines before showing up in the lab, despite the fact that the outcome of research facility exercises is subject to the nature of pre-lab planning. This is shown by the kinds of questions that students ask during the laboratory session and by the fact that they don't finish the tasks that need to be done. The research facility manual, direct direction, new hardware and materials, specialized mastery, hypothetical foundation and using time effectively have all likewise been laid out as potential reasons for mental disharmony. In laboratory classes, undergraduate students frequently experience cognitive overload, decreasing their chances of achieving desired learning outcomes. In large classes with fewer resources, such as unit operations (having a single colloid mill), this issue can become even worse. Additionally, post-laboratory exercises, which can take up to five hours per activity, typically consume more time from students than pre-laboratory preparations. The majority of these tasks involve writing reports, which are typically finished or completed in part outside of the laboratory.

Description

It has been reported that the flipped classroom (FC) model makes it easier to reduce the amount of new information students are exposed to when they enter the laboratory. The FC is a type of blended learning (BL) that changes how time is spent in and out of the classroom. Prior to the face-to-face class in the FC model, students are exposed to initial learning materials in a variety of ways, many of which are learner-controlled and technology-based, such as instructor-provided videos. Due to independent learning and critical thinking, flipped laboratory classrooms (FLC) can produce better learning outcomes than traditional lectures when well-designed, organized, and implemented. Because it makes it easier for students to actively engage with the curriculum in a variety of ways, the FC falls under the purview of constructivism as a learning theory. According to research, FC encourages students to actively engage with lecture materials, spend more time on preparatory work, and get more involved in classroom activities by allowing them to learn at their own pace, in their own space, and by allowing them to take control and responsibility for their education [1-5].

In many universities, traditional pre-laboratory activities include reading the laboratory manual, taking a paper-based quiz, or passively listening to a brief lecture before the laboratory session begins. Given the prominence of technology as a pedagogical tool, there has been a paradigm shift toward pre-laboratory exercises that incorporate various multimedia, such as videos and online quizzes. Videos used as pre-laboratory materials can help students participate and encourage thorough planning. Students in undergraduate chemistry were able to reduce their post-lab workload, according to Poganik and Cigi, by completing more of their exercises prior to entering the laboratory. The FC model was utilized in a semester-long group project for undergraduate students enrolled in a course on sensory evaluation of foods in a study by Donovan and Lee. In a large second-year undergraduate analytical chemistry class, the findings demonstrated that the flipped laboratory accurately mirrored lecture content, allowed for the completion of the majority of group projects in the classroom, and improved student learning by integrating lecture knowledge with hands-on pre-lab video demonstrations and online quizzes. The positive effect on students' perceptions of learning was attributed to higher levels of preparation.

In addition, it was reported that self-assessment techniques and video clips were useful pedagogical tools for increasing student success and learning outcomes in mechanical engineering labs. Chittleborough and coworkers, in a chemistry lab course for nonmajors, Treagust investigated the efficacy of online pre-lab activities (quizzes). After completing the online tasks, students reported feeling more prepared for the lab than when they read the lab instructions before the sessions. According to a number of studies, students prefer the

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flipped classroom to traditional teaching methods because they can learn at their own pace and enjoy laboratory sessions. The added benefit of online pre-lab quizzes is that they give students formative feedback in real time before the lab sessions. Access to technology to view videos or complete online quizzes can be difficult for economically disadvantaged students. Students may misunderstand the material and be unprepared for learning activities if the video quality is poor.

Pre-laboratory exercises have not been used in undergraduate food science and technology classes, despite evidence pointing to their potential advantages and the flipped laboratory classroom. In addition, students' performance and perceptions of pre-laboratory exercises in food science and technology courses, in which they are expected to integrate theory and practice and comprehend intricate scientific concepts, are poorly understood. As a result, the purpose of this study was to assess the students' use of preparation resources, as well as their performance and perceptions of flipped classroom-facilitated pre-laboratory classes [1-10].

Conclusion

At a University of Technology in South Africa, Food Technology 1 (FOT150S) is a one-year, two-semester course. All students enrolled in the Diploma in Food Science and Technology must take FOT150S, a course that combines theory and practice. Pre-laboratory exercises were given to first-year students enrolled in the course in 2018 (n = 83) and 2019 (n = 106) respectively. The activities and structure of the course remained the same for two years. An informed consent form detailing the research and data collection was requested from participants. Participants were informed that their participation in the survey, or lack thereof, would not affect their grades for the course. The University's Centre for Higher Education Development ethics committee granted the study ethical approval.

Acknowledgement

None.

Conflict of Interest

None.

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