Improving Student Ability in English Language Life Science Laboratory Research Through Student-Created Videos

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The life sciences are a critical area of research today. Japanese researchers play a major role in global research, although often handicapped by insufficient English language abilities. Educational efforts to train students in life sciences and to improve their ability to function professionally are now facing special problems due to the COVID-19 crisis, a problem that may be with us for some time. Japanese science education traditionally depends on senior student guidance of junior students in laboratory research. This research aims to test whether creating and using student videos of life science laboratory research experiments can improve student English language abilities while limiting the number of people and total time in laboratory work.

Rationale

Recent changes in the modes of classroom instruction mandate a review of typical classroom assignments. Research shows that by creating content videos students enjoy the classroom activities and find them more relevant (Greene, 2014). During the production stage, “knowledge creation, collaboration and digital literacy” developed the most, along with English reading and listening skills (Puspa, 2016).

Based on prior research in Life Science and as a teacher of English, it is apparent that insufficient English language skills in the field of Life Science are preventing Japanese university students from developing their scientific careers. Directly relevant language training integrated into their Life Science training could be most effective and efficient, however, such a program has not been developed or tested. One such possibility within the unique Japanese university context would be lab videos.

Method

Students in particular labs will be asked to create videos explaining laboratory practice. Creating videos of laboratory experiments will require students to utilize English vocabulary and the appropriate registers to describe equipment, methods, and results. These videos can be then used as instructional materials for junior students who traditionally depend on their seniors' guidance.

This has the additional benefit of freeing senior students to focus on their studies and reduce the number of students in the lab. Copies of the videos will also be used in Scientific

English classes.

The video recordings will include the following experiments: i) genome editing, ii) cell staining using fluorescent protein, iii) PCR, iv) recombinant protein, v) drug affinity, and vi) cell culture method.

These experiments require special language knowledge, as demonstrated in the following experimental design of flowchart of overexpression and purification of recombinant protein in E. coli.

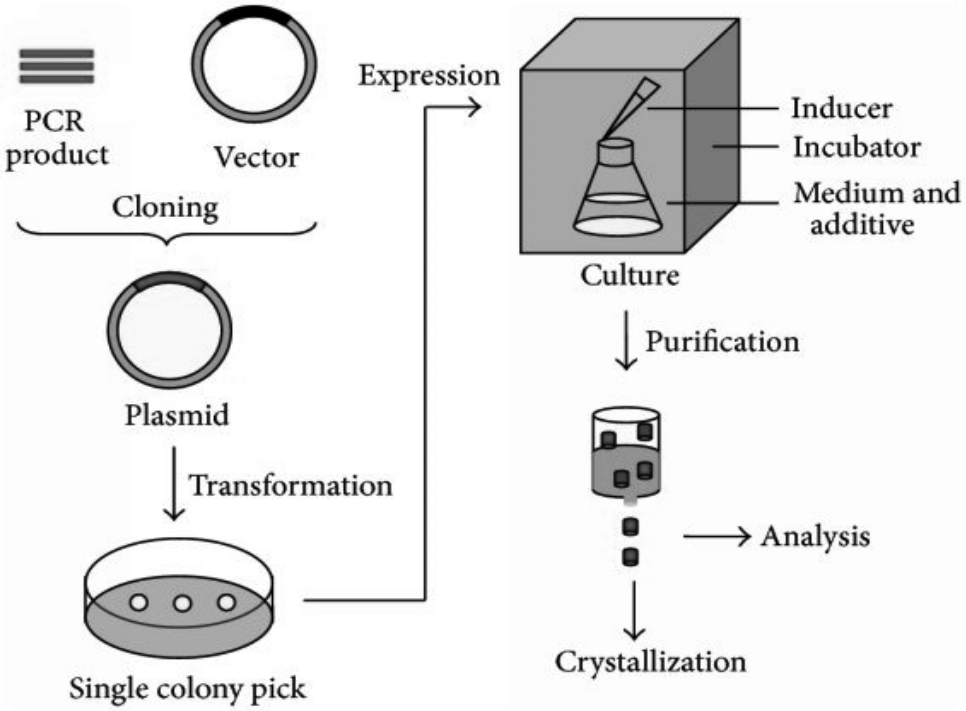

Figure 1. Overexpression and purification of recombinant protein in E. coli. Adapted from "Two-Dimensional Crystallization Procedure, from Protein Expression to Sample Preparation" by Kuang Q., Purhonen. P., and Hebert H., 2015, BioMed Research International. https://www.researchgate.net/publication/282832157

Procedure

The research will include three stages:

Stage 1, year 1:

- Creation of a test to ascertain the knowledge of basic laboratory vocabulary and scientific terms related to lab work. The test will include multiple-choice questions. The results of this test will be compared to a similar test given at the end of Stage 3.
- Test given to 2nd year Life Science students and results recorded.
- Video equipment purchased and prepared for student use.

Stage 2, year 2:

• Students create videos of experiments, with and without commentary in English. Because of the chance of contamination, it is not advisable to talk while conducting experiments, so the videos can be narrated afterward. Students and lab technicians will receive an honorarium for their work creating video experiments, which will include time outside their classes.

• Editing of student-made videos

Stage 3, year 3:

• Student-made videos used by lab students and in Scientific English classes.

• Students Group 1 (video creators), Student Group 2 (video users), Student Group 3 (control) take a multiple-choice test (exit test) that checks knowledge of life science vocabulary and phrases.

• The results of the test compared to test scores from Stage 1 scores.

• Based on final test results, a conclusion can be drawn whether or not creating videos of lab experiments improves students' knowledge of scientific English.

Practical applications - debates

It is my observation that when students get involved in a more dynamic discussion that includes elements of competition and teamwork, such as debate, they become more willing to use English, without caring too much about mistakes (Grave, 2001). However, the skills, such as asking and answering challenging questions, interrupting to gain control of the topic, and disagreeing with others, are lacking to the effect that science students may become shut off in an international setting. Such events, like a conference or working in an international lab may present obstacles to students, thus developing debate skills is an effective way to amend these problems. The student-made videos of experiments serve not only as tutorials, but offer reflection (Sears, 2018) and can facilitate debates about the methods and outcomes.

Practicing debate skills in English can equip science students with many useful skills that can prove detrimental in their future: looking at a subject from different perspectives, questioning the validity of research, asking questions, and knowing how to fend off questions of others, a valuable skill in Q and A part of a conference presentation, and negotiating research funds.

The following chart represents an overview of scientific English education using the latest scientific experimental video.

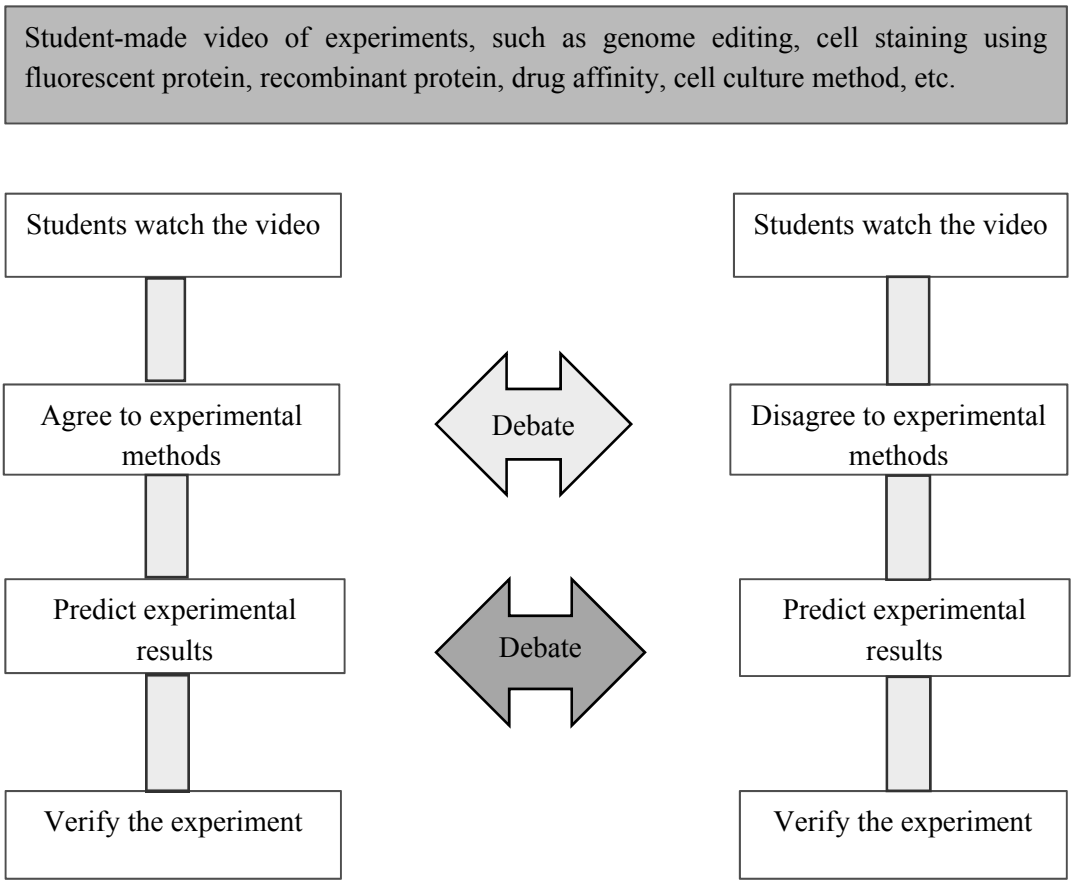

Figure 2. Practical application of student-made videos of lab experiments in class debates.

Conclusion

Because of the COVID-19 pandemic, and ensuing remote education, many educators have turned to video conferencing and other Internet-based activities for the exchange of information and teaching. Within sciences fields, there is a trend to use such technologies to replace actual hands-on experience.

In an unstable environment due to the Covid-19 pandemic, where social distancing may be necessary for some time, making videos of lab experiments may be a solution to keep students from crowding into labs for initial training. Even after the pandemic ends, from an educational perspective, student-made videos may provide benefits to both students and instructors.

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