

Learning in depth with the bespoke rubric-supported online poster presentation

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ABSTRACT

In our course of Biomedical Imaging, we introduced a research project as an assignment that included an online poster presentation. To assess the assignment, an adjusted criteria sheet was created, where it facilitated providing students with an effective feedback linked to particular criteria. Students are expected to produce a scientific poster to present the result of their investigation and upload it to an online discussion board. In addition, they are required to read their colleagues' works and provide peer-feedback by asking quality questions about principles and results, also on-line. Subtle distribution of marks in the rubric balances focus between preparing poster and providing peer-feedbacks.

Keyword list: bespoke rubric, online poster presentation, Biomedical Imaging course, peer-feedback, assessment

1. INTRODUCTION

The authors have been involved in teaching a 1-semester course named “Biomedical Imaging”. The course was designed for undergraduate students in health science and biotechnology disciplines. It aimed to provide a solid introduction to fundamental concepts of major imaging modalities currently used in clinical and biomedical research settings and relate them to cutting edge technologies and their possible applications to medicine.

In recent years along with advances in photonics, the number of available biomedical imaging techniques have burgeoned. There are variety of imaging methods and techniques that are suitable for particular situations. It makes it impossible to cover all methods and related cases in a single semester course. Therefore, encouraging students to engage in self-discovery of related topics and share them with their peers is an efficient alternative way. To address this issue, a research project was added to the course as a Teaching and Learning Activity (TLA).

Constructive alignment¹ requires that all TLAs included assessment task support Intended Learning Outcomes (ILOs) of the course. In other word, assessment tasks are treated as a learning activity and should be merged into curriculum. As Ramsden² mentioned, students will learn what they think they will be assessed on. Thus inserting the research project to the course will be effective, providing its associated assessment can be fully merged into the course curriculum.

2. POSTER ASSIGNMENT

In this research project activity, students are required to select three preferred research subjects from a range of research topics and register them in the early weeks of the semester. They are promptly assigned to a topic from their preferences. Then they have enough time in the rest of semester to think about the topic and find a method to study and investigate their chosen subject individually. The number of topics in the list is related to the number of students in the class where the maximum of three students work on a common topic independently. The list of topics covers different areas in the biomedical imaging field, focusing on advanced microscopy methods. The following items display a typical list of topics:

1. The use of quantum dot imaging in studying cell function
2. The use of super-resolution microscopy to study cell function
3. Use of FRET to study protein-protein interactions in cells

4. The use of fluctuation techniques to study the motions of molecules
5. Fluorescence optical imaging of live animals
6. The imaging of temperature changes within living organs
7. Fluorescence imaging of dynamic structures
8. Label-free imaging using intrinsic photonic properties
9. Fluorescent biosensors for networks and pathways
10. Single molecule imaging at the plasma membrane
11. Microwave imaging for breast cancer detection
12. Medical applications of terahertz radiation, imaging in particular
13. Principles and biomedical applications of Atomic Force Microscopy
14. Carbon nanotubes – possible applications in biomedical imaging
15. Imaging the gut using a radio-transmitting device ('Pill-cam')
16. Interfacing neurons with silicon microcircuits: checking structure
17. A multi-technique biosensor device to detect and treat a disease
18. Nano-diamonds as optical probes in bio-imaging

Students are expected to produce a scientific poster to present the result of their investigation and upload it to an online discussion board a month before the end of semester. Therefore, there is time for other students to read their colleagues' work and provide peer-feedback by asking quality questions about principles and results, also on-line. As a supplementary activity, they are also expected to provide peer-feedback for at least four other posters in two topics and respond to the questions asked of them.

Poster should highlight the main points on assigned topic and be limited to one A4 page. Its style must comply with logical progression from introduction to conclusion. All posters must be posted on the online Discussion Board facility (Blackboard) through a plagiarism detection system called Turnitin.

Other part of assignment is providing peer-feedback and responses. Students must also read four other posters from their own assigned topic and one other topic. They are assigned posters that must look at and ask questions on. Each student can expect around four questions, which should be answered as precisely as possible. The 100 marks for the assignment are apportioned based on the rubric. Students who assigned the same topic are encouraged to reply questions even related to work of other students. It promotes a discussion among students.

Students' performance is assessed by two different assessors and in the case of big difference between assessors the third assessor will be employed. All assessment is based on a rubric. Feedback is provided to students from the assessors via the Blackboard.

3. A TYPICAL DISCUSSION THREAD

The complementary part of the assignment is attending online poster presentation by providing feedbacks for peers and responding to the asked questions. This part increases discussions among students. Some typical questions and answers are as the following:

Topic of the use of super-resolution microscopy to study cell function

“Hi Joe Doe

Well done! What are the limitations of the Super Resolution Microscopy when it comes to study biological Structures?
Thanks.”

“Hi Jane

Thanks!

The limitation of SRM has improved both lateral and axial resolutions, achieving 50-70nm resolution in all three dimensions. Hence, the molecular resolution is roughly about 1-5nm. Living cells potentially move faster than super resolution microscopes can capture images. As the latest new super resolution technologies are based on illumination, nonlinear fluorophore responses and the localisation of single molecules enable to investigate the structure and function of biological cells.”

Topic of Nano-diamonds as optical probes in bio-imaging

“Hi Jeff,

Based on your research, I understand that nitrogen vacancy centre in the nanodiamond has the function of fluorescence and it is important part for its use. My question is: How is the NV centre (a flaw in nanodiamond) made? Do we just need to find the nanodiamond particles that have a NV centre from naturally formed nanodiamonds or is it possible to have man-made NV centres? If so, how is it made?

Regards, Rob”

“Hello Rob,

Thank you for your question./

There are two possible ways to create the nitrogen vacancy centres. One way is through the use of Chemical Vapour Deposition, which is a chemical process in which deposition of gaseous reactants on to a substrate occurs, in this case the nitrogen donor molecules is immobile from the deposition where as the vacancies in the nanodiamond are highly mobile and can therefore easily undergo diffusion of the lattice. Another way that nitrogen vacancy centre is produced is through the growth of the nitrogen vacancy into the centre as a unit as their creation pertaining to process occur on the growth surface.

I hope that answers your question

Cheers, Jeff”

These typical questions and answers demonstrate how peer-discussion works, where these interactions can ultimately deepen learning by supporting ILOs.

4. THE RUBRIC

Criterion-referenced assessment can be implemented to avoid comparing students’ works and reference to the achievement of others in the class. This method of assessment is the process of evaluating product of students against a set of pre-specified criteria³. This criteria sheet is known as grading rubrics and is the central part of criterion-referenced assessment.

The rubric facilitates providing students with an effective feedback linked to particular criteria. It reduces effort to deliver feedback and enhances its quality. Although rubric is time-consuming to construct it is time-saving to use for both students and instructors. Table 1 demonstrates the bespoke rubric related to the research project assignment. It is comprised of five levels of achievement that are generally used at Swinburne University of Technology includes High Distinction, Distinction, Credit, Pass and Fail.

5. DISCUSSION

The introduced project activity exposes learners to a new complex and challenging learning situation to study about advanced microscopy techniques. Where it deepens learning by engaging students to go through fundamental concepts of imaging method and related physics. This TLA is an engaging item in the course with introducing contemporary topics of Nano and Bio photonics applications in Biomedical Imaging. Moreover, it exposes students to a complex situation that need to be handled by learning new skills like scientific writing and preparing scientific posters. One can call this process “learning through production” or collaborative learning⁴.

The project is a high-level task with well-defined expectations set out in a complementary rubric. The bespoke rubric includes statements of standard descriptors and weighting for each criterion to encompass the intents of criterion-referenced assessment. It allows students to evaluate their own work before submission and lets instructors to mark posters without comparison.

The marks for the assignment divided into two major parts, one preparing poster itself and second, providing and responding to feedbacks. This way of distributing marks emphasises that reacting to poster presentations is unneglectable part of assignment and students need to consider this part to receive desirable mark.

The rubric enhances summative assessment by enabling detailed grading based on a set of pre-specified criteria. In addition, it promotes compatibility of judgment between two assessors and reduces the frequency of having to refer to a third assessor. Moreover, the rubric can facilitate providing feedback by linking to relevant criteria that will consequently create formative assessment. Further, it aligns the project activity with Intended Learning Outcomes (ILOs) of the course. Using online learning delivery and management system for poster presentation and discussion changes the delivery of the course from merely face-to-face mode to a blended mode where it boosts the efficiency of presentation in information interchange among students to provide peer-feedback and enhances the quality of grading based on documented action and reaction in presentation. Ultimately, the provided feedbacks empower students to regulate aspects of their approach to research the topic within a model of self-regulated learning⁵.

6. CONCLUSION

From these advantages, we can reach the conclusion that the project activity along with its adjusted rubric can deepen learning in the Biomedical Imaging course, where, introduced rubric and requirement to react on feedbacks lead students to be self-regulated learners.

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Table 1. The grading rubric for the research project assignment.

Criteria	High Distinction (80-100%)	Distinction (70-79%)	Credit (60-69%)	Pass (50-59%)	Fail (<50%)
<p>Introducing the topic in a scientific way.</p> <p><i>Weighting 15%</i></p>	<p>Fully relevant and comprehensive research literature. Citing relevant works. Mentioning highly regarded works in the field. The topic is critically examined.</p>	<p>Relevant and mostly comprehensive research literature. Citing relevant works. Mentioning some highly regarded works in the field. The topic is critically examined.</p>	<p>Relevant research literature, but does not cover all crucial aspects. Citing some relevant works, but relies on single research group. The topic is critically examined fairly well.</p>	<p>Relevant research literature, but misrepresenting some important aspects. Citing a few relevant works with some outdated or inappropriate materials. The topic is critically examined with deficiencies.</p>	<p>Irrelevant research literature that does not address the topic. The topic is not critically examined.</p>
<p>The quality of the explaining concepts and the topic background in discussion.</p> <p><i>Weighting 25%</i></p>	<p>All methods and techniques are mentioned. Mathematics involved and fundamental concepts are evaluated. Advantages and disadvantages are considered thoroughly. Modern applications of the investigating subject are discussed.</p>	<p>All methods and techniques are mentioned. However there is a lack of comprehensive evaluation. Advantages and disadvantages are considered. Modern applications of the investigating subject are discussed.</p>	<p>Relevant methods and techniques are mentioned and fundamental concepts are evaluated. Some advantages and disadvantages are considered. Modern applications of the investigating subject are discussed.</p>	<p>Some methods and techniques are mentioned and fundamental concepts are evaluated, but inaccurately. Advantages or disadvantages are considered. Some modern applications of the investigating subject are discussed.</p>	<p>Poor understanding of the scientific principles involved. Unrelated advantages or disadvantages are considered. Modern applications are not discussed.</p>
<p>Conclusion</p> <p><i>Weighting 10%</i></p>	<p>The conclusion is succinct and correlates completely with information conveyed by literature and discussion.</p>	<p>The conclusion is relatively correlates with the information conveyed by literature and discussion.</p>	<p>The conclusion is approximately correlates with the information.</p>	<p>The conclusion is disconnect between the conclusion and provided information.</p>	<p>There instances where there is disconnect between the conclusion and provided information.</p>

<p>The extent to which the poster is presented in a professional style appropriate for a scientific presentation.</p> <p>The extent to which citations and referencing are in accordance with the Swinburne referencing style.</p> <p><i>Weighting 10%</i></p>	<p>Logical progression of topic from introduction to conclusion that make it possible to follow the concepts.</p> <p>All cited literature is well integrated.</p> <p>Citations and reference list are fully compliant with the introduced style.</p>	<p>Logical progression of topic from introduction to conclusion.</p> <p>All cited literature is well integrated.</p> <p>Citations and reference list are mostly compliant with the introduced style.</p>	<p>Logical progression of topic from introduction to conclusion. However, there are occasions when the writing style and format does not facilitate rapid understanding of concepts.</p> <p>Cited literature is mostly well integrated.</p> <p>Citations and reference list are mostly compliant with the introduced style.</p>	<p>There is a progression of topic from introduction to conclusion. However, it is not well organised.</p> <p>Some cited literature is not well integrated.</p> <p>Citations and reference list are compliant with the introduced style.</p>	<p>The style of poster is informal.</p> <p>Cited literature is not integrated.</p> <p>Citations and reference list are deviate from the introduced style.</p>
<p>Providing quality peer-feedback. Appropriate reaction to feedbacks.</p> <p><i>Weighting 40%</i></p>	<p>Providing a question for at least four other students' works.</p> <p>The provided questions are clearly relevant to the topics of posters and reveal exceptional insight into the scientific principles and results.</p> <p>Responding to asked questions precisely and comprehensively.</p> <p>Answers are respectful and displaying advanced knowledge of the topic.</p>	<p>Providing a question for four other students' works.</p> <p>The provided questions are clearly relevant to the topics of posters and reveal insight into the scientific principles and results.</p> <p>Responding to asked questions comprehensively.</p> <p>Answers are respectful and displaying advanced knowledge of the topic.</p>	<p>Providing a question for at least three other students' works.</p> <p>The provided questions are relevant to the topics of posters.</p> <p>Responding to asked questions.</p> <p>Answers are respectful and displaying some degree of advanced knowledge of the topic.</p>	<p>Providing a question for at least two other students' work.</p> <p>The provided questions are mostly relevant to the topics of posters.</p> <p>Responding to some asked questions.</p> <p>Answers are respectful and displaying some degree of knowledge of the topic.</p>	<p>No question provided for peers.</p> <p>There is no response to asked questions.</p>