Pedagogy for Higher Education Large Classes (PHELC21)
Online, 25th June, 2021
DOI: 10.5281/zenodo.4975114

A problem-based group task for exploring quantitative research design and analysis: facilitating collaborative problem-solving with large classes online

Jamal Lahmar
School of Education, University of Sheffield, England

Abstract
This paper explores the adaptation of a problem-based group activity for teaching large classes online during the Covid19 pandemic. Semi-structured discussion, active learning and provision of a positive collaborative atmosphere are foregrounded as priorities in the adaptation process for maintaining learner engagement online. The need for expanding and refining instructional prompts was identified as an unexpectedly useful implication of the developmental process likely to feed back into large class face-to-face teaching in the future.

Keywords: *Collaboration, Problem Solving, Quantitative Methods Teaching, Large Class*

1. Introduction

In this paper I reflect on experiences of adapting a small-group, collaborative learning activity for use in an online teaching environment with large classes during the Covid19 pandemic. While some commentators have sensibly warned that "simple 'onlinification' of face-to-face lectures will not result in positive experiences for academics or students" (Lee, n.d., para. 7) my aim here is to share a rather more positive example of intentionally emulating aspects of teaching that have been argued to be challenging with "large classes" (Kirstein & Kunz, 2015) in online teaching contexts (Stone & Perumean-Chaney, 2011).

2. The Learning and Teaching Context

The task presented is situated in a two-hour teaching session on quantitative research methods courses. Sessions combine limited direct instruction interspersed with collaborative activities for smaller sub-groups: "facilitating a 'small class feel'… breaking up a traditional lecture into smaller segments and incorporating active learning activities." (Lynch & Pappas, 2017, pp. 199-201). In this example, learners are guided to collaboratively explore the concepts of sampling, inference and correlation without the need for demanding numerical calculations.

This activity has been used with undergraduates and postgraduates in Journalism Studies (50 students), Education Studies (up to 70 students) and Medicine (20 students) at one higher education institution in the United Kingdom. Though not the largest groups of students on such programmes, "the effects of class size are varied and contextual" (Mulryan-Kyne, 2010, p. 176) and these classes are considered "large" in the sense that a pedagogical approach "not usually thought to be appropriate for large group situations" (Kirstein & Kunz, 2015, p. 223) is being used in "environments where the quality of student learning may be impacted, negatively, by the number of students in the class" (Hornsby & Osman, 2014, p. 719).

Prior to mandated moves to online teaching, these sessions took place in workrooms or lecture theatres where learners' engagement with small-group activity could be monitored and guided by circulating the teaching space (Kirstein & Kunz, 2015; O'Hanlon et al., 2019). These sessions have subsequently been taught online using the Blackboard Collaborate (BbC) platform during a period of Covid19 related restrictions. Though BbC can facilitate many of the structures of the aforementioned teaching-format (e.g. "Breakout Groups", Blackboard Inc., 2021), lecturer oversight during small-group session-phases is restricted to visiting with one group at a time and limited feedback from learners via a text-chat facility.

3. Principle Aims of the Task Design – Inclusive, Active and Enjoyable Collaborative Learning

3.1. Fostering a Positive, Enjoyable Experience of Research Methods Teaching

I selected this particular activity for review due to the potentially dry character commonly associated with quantitative methods teaching (Bailey, 2019; Williams et al., 2008) and because my pedagogical response to such a challenge has previously been dependent on the affordances of traditional teaching spaces and in-person, face-to-face teaching.

A central tenet of my approach has been to ensure that student-centred tasks should be enjoyable undertakings in their own right. I use semi-guided problem solving activities as a catalyst for the interpersonal communication so-hindered by the move to offsite learning for many students, not be confused with the notion of "student satisfaction" in the consumerised, neoliberal sense but instead as a more personal, emotional state of happiness during the learning process (Elwick & Cannizzaro, 2017). Similarly, from the teachers' perspective, the enjoyment I draw from my practice has been quite dependent on the in-person interaction of the lecture theatre and the classroom for many years, aspects of my professional role that I perhaps did not fully appreciate until they were so abruptly curtailed. I am hopeful therefore that efforts to facilitate collaborative and productive discussions – as evident in the plenary feedback following the tasks themselves – will also provide a positive, pleasant space for learners to connect in a manner at least partially analogous to the lecture theatre and seminar room.

3.2. Inclusive, Active Learning

The design and adaptation of this task aligns with Hornsby's suggestions (2020) to prioritise active and collaborative learning opportunities whenever teaching online, and that that these opportunities are particularly important for learners in larger classes as a means of "promoting cognitive elaboration, enhancing critical thinking, providing feedback, promoting social and emotional development" (Mulryan-Kyne, 2010, p. 180, citing Cooper and Robinson, 2000). In light of the quantitative subject-matter, these principles also complement Bailey's advice (2019) to not only "Do something with real data, right away…" but – as a potentially intimidating bivariate data activity – to design a task where "the conversation proceeds in commonsense terms and avoids statistical jargon, it will be accessible to all students, providing a foundation for statistical reasoning" (2019, sec. 3). The task-design also integrates a "playful" dimension (Nørgård et al., 2017) with the device of an undisclosed variation of the dataset between groups discovered only in the subsequent plenary discussion.

4. The Correlation and Sampling Task

Students are placed into small subgroups (around five students) where they may annotate on-screen resources, discuss task content verbally using their microphones or contribute ideas using a text-chat facility. The brief is to select a sample of eight points of bivariate data from a synthesised "population" of values (Figure 1), plot these points by-hand on the axes provided, then to consider descriptive and inferential aspects of the analysis process: describe the correlation observed in the sample then reflect on the degree to which the group might make an informed assertion about the population they have sampled from.

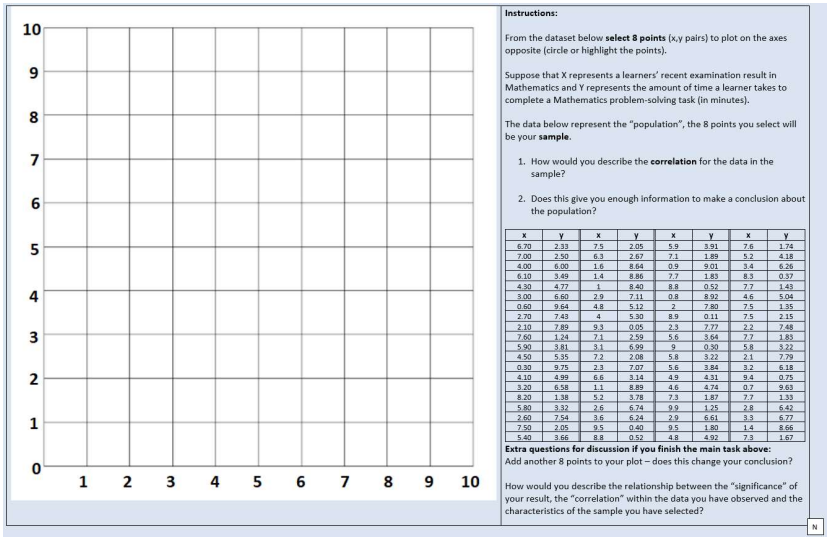

Figure 1. The format of the "Correlation and Sampling Task" (one of three possible versions provided to students)

When used in a face-to-face setting, the task is introduced verbally with only the on-sheet prompts (Figure 1) as a reminder. However, as I reused this task across different cohorts and subject-areas online, I found myself needing to expand and refine the series of prompts provided on session-slides (see Figure 2) to account for the lack of a facilitating lecturer's attention throughout the task. Initially, it became apparent that technical instruction on the use of BbC for on-screen annotation was helpful to ensure accessibility of the activity. However, further reflection on routines I had previously used to manage these activities in face-to-face settings led to the inclusion of additional prompts on group organisation (e.g. encouraging students to nominate a chairperson, Koh et al., 2010) and encouraging purposeful note-taking to inform contributions to the follow-up plenary discussions.

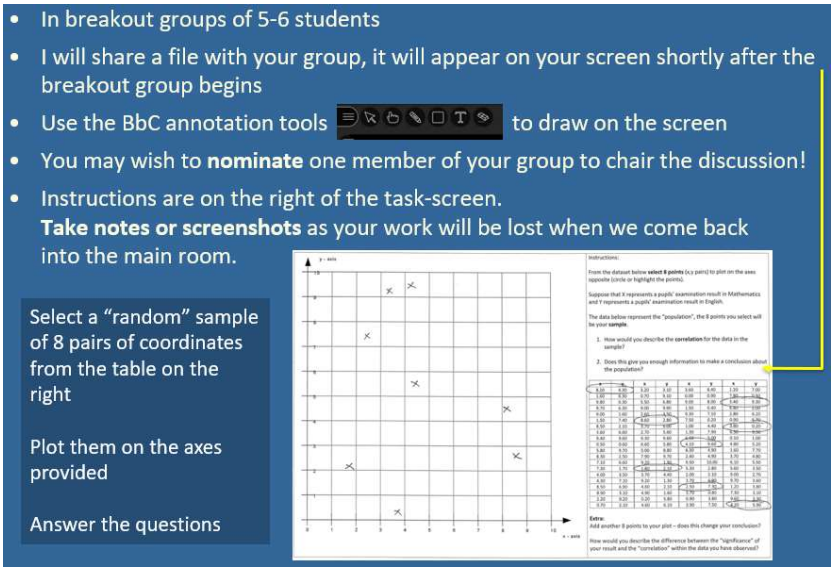

Figure 2. Instructions provided to students prior to the start of the task, iteratively expanded based on personal reflection and learner feedback.

At the end of the allocated time (typically ten to fifteen minutes) students are asked to indicate if they are ready to conclude their breakout discussion. The large lecture class is then reconvened for volunteers to share responses to the task and to consolidate points of learning.

It is only at this plenary stage that nuances of the task become apparent. Groups will have been randomly allocated one of three variants of the task-document, each with a subtly different research context and dataset. For example, synthesised data pertaining to mathematics attainment and problem-solving time would typically lead to the identification of a negative correlation whereas a dataset measuring chocolate consumption and attainment in artistic subjects includes randomly generated, uncorrelated data. Students typically focus on the sampling process itself to begin with, recognising that the random selection of cases could give rise to different results across groups, and it is useful to consider these competing and possibly surprising complications in tandem.

The plenary discussion is structured to progress broadly through successive layers of the SOLO taxonomy (Biggs & Collis, 1982; Stålne et al., 2016) beginning by asking students to simply report on the correlation observed in their selected sample and moving towards more sophisticated and evaluative comments. Task-groups identify a range of patterns in their data including positive and negative correlations of various strengths and, in some cases, no obvious correlation whatsoever.

It is not uncommon for students to notice that they have focused entirely on the abstract, mathematical features of the task and have neglected the context the data were referring to. The revelation that groups in fact received *different* datasets is dealt with in a deliberately playful manner, where students' "failure is not only encouraged, but a necessary part of the learning paradigm" (Nørgård et al., 2017, p. 272). The discussion proceeds – organically or with some prompting from the lecturer – towards exploring the uncertainty arising from students' initially confident proclamations of having found "the answer", the inherently limited strength of inferences made on a small sample and the importance of expressing a statistical result in terms of the variables and research context under examination (Gal, 2004; MacInnes, 2014; Payne, 2011).

5. Reflection on Implications for Practice

The reflection on pedagogical priorities necessitated by an unexpected shift to "emergency remote teaching" (Hodges et al., 2020, para. 5) during the Covid19 pandemic has been an intriguing if challenging experience. I realised how centrally my teaching practice is guided by the principle that "active learning can be of great benefit to students who can find themselves in larger class sizes during their higher education experience" (O'Hanlon et al., 2019, p. 3). I am also mindful that the unexpected move to mandatory online teaching presented a positive opportunity for my own learning, and the refinements necessary to make this task-type work in an unfamiliar environment – reflecting on classroom management routines and guidance and using these to provide prompts for student-centred activity – are likely to be beneficial for teaching with even larger classes face-to-face in the future (Stone & Perumean-Chaney, 2011; Lynch & Pappas, 2017). It is therefore my hope that this paper might demonstrate a more positive view of the potential for adapting existing pedagogical approaches involving collaborative discussions for use across offline and online modes and the subsequent points of learning for practitioners teaching in such spaces.

References

Bailey, M. A. (2019). Teaching statistics: going from scary, boring, and useless to, well, something better. *PS: Political Science & Politics*, *52*(2), 367–370. https://doi.org/10.1017/S1049096518002044

Biggs, J. B., & Collis, K. F. (1982). *Evaluating the Quality of Learning: The SOLO Taxonomy (structure of the observed learning outcome)*. Academic Press.

Blackboard Inc. (2021). *Breakout Groups: Blackboard Help*. Retrieved from https://help.blackboard.com/Collaborate/Ultra/Moderator/Moderate_Sessions/Breakout_groups

Elwick, A., & Cannizzaro, S. (2017). Happiness in higher education. *Higher Education Quarterly*, *71*(2), 204–219. https://doi.org/10.1111/hequ.1212

Gal, I. (2004). Statistical literacy: meanings, components, responsibilities. In D. Ben-Zvi & J. B. Garfield (Eds.), *The Challenge of Developing Statistical Literacy, Reasoning, and Thinking* (pp. 47–78). Kluwer Academic Publishers.

Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020, March 27). *The difference between emergency remote teaching and online learning*. Retrieved from https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning

Hornsby, D. (2020). Moving large classes online: Principles for teaching, learning and assessment. *Proceedings of the Pedagogy for Higher Education Large Classes (PHELC) Symposium*. https://doi.org/10.5281/zenodo.3893426

Hornsby, D., & Osman, R. (2014). Massification in higher education: Large classes and student learning. *Higher Education*, *67*(6), 711–719. https://doi.org/10.1007/s10734-014-9733-1

Kirstein, M., & Kunz, R. (2015). Student-centred approach to teaching large classes: Friend or foe? *Meditari Accountancy Research*, *23*(2), 222–246. https://doi.org/10.1108/MEDAR-06-2013-0025

Koh, M. H., Barbour, M., & Hill, J. R. (2010). Strategies for instructors on how to improve online groupwork. *Journal of Educational Computing Research*, *43*(2), 183–205. https://doi.org/10.2190/EC.43.2.c

Lee, K. (n.d.). *Coronavirus: Universities are shifting classes online – but it's not as easy as it sounds*. The Conversation. Retrieved from http://theconversation.com/coronavirus-universities-are-shifting-classes-online-but-its-not-as-easy-as-it-sounds-133030

Lynch, R. P., & Pappas, E. (2017). A model for teaching large classes: facilitating a "small class feel". *International Journal of Higher Education*, *6*(2), 199. https://doi.org/10.5430/ijhe.v6n2p199

MacInnes, J. (2014). Teaching quantitative methods. *Enhancing Learning in the Social Sciences*, *6*(2), 1–5. https://doi.org/10.11120/elss.2014.00038

Mulryan-Kyne, C. (2010). Teaching large classes at college and university level: Challenges and opportunities. *Teaching in Higher Education*, *15*(2), 175–185. https://doi.org/10.1080/13562511003620001

Nørgård, R. T., Toft-Nielsen, C., & Whitton, N. (2017). Playful learning in higher education: Developing a signature pedagogy. *International Journal of Play*, *6*(3), 272–282. https://doi.org/10.1080/21594937.2017.1382997

O'Hanlon, D., Duffy, S., Fannon, L., Harding, N., & Ryan, S. (2019). *Team Based Learning for enhanced engagement in larger class settings: Experiences of business school staff and students*. https://doi.org/10.5281/ZENODO.3251703

Payne, G. (2011). *Teaching quantitative methods: Getting the basics right*. Sage Publications.

Stålne, K., Kjellström, S., & Utriainen, J. (2016). Assessing complexity in learning outcomes – a comparison between the SOLO taxonomy and the model of hierarchical complexity. *Assessment & Evaluation in Higher Education*, *41*(7), 1033–1048. https://doi.org/10.1080/02602938.2015.1047319

Stone, M. T., & Perumean-Chaney, S. (2011). The benefits of online teaching for traditional classroom pedagogy: A case study for improving face-to-face instruction. *Journal of Online Learning and Teaching*, *7*(3), 393-400.

Williams, M., Payne, G., Hodgkinson, L., & Poade, D. (2008). Does British sociology count? Sociology students' attitudes toward quantitative methods. *Sociology*, *42*(5), 1003–1021.