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Academic English course for the health sciences: evolution towards a flipped classroom

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Abstract

The transition from university face-to-face teaching to blended learning can be challenging. This educational design research study investigated the optimal design for a blended and flipped learning approach to a scientific English course and the impact on student motivation and learning of incorporating pedagogical principles from adult and work-based learning. Using student feedback and teacher reflections, we evaluated three iterative cycles of development from trialling of e-modules in a face-to-face course, to a fully online course, to a blended learning approach with a flipped classroom. We found that student participants were increasingly satisfied over time and conclude that the final course design is the optimal approach for our context. Integrating principles of direct interest from adult learning and involvement of current work supported participant motivation, while self-paced e-modules allowed direct application of new knowledge. Coherence between pre-class, in-class, and post-class activities in the flipped classroom helped ensure relevant learning activities.

Introduction

The Covid-19 pandemic forced an abrupt move from face-to-face teaching in universities to online teaching. This created new challenges for teachers in retaining the links between the social and cognitive aspects of learning and determining the most suitable technology for each educational task (Carrillo & Flores, 2020). For many teachers who had not previously used online approaches, this was an unknown quantity associated with great uncertainty and was even referred to as 'covido-pedago-phobia'– the fears experienced by teachers when they are compelled by the Covid-19 pandemic to rapidly transition from conventional teaching to an online educational milieu (Eachempati & Ramnarayan, 2020). Online learning technologies developed rapidly (Dash et al., 2021), however, and it has become clear that they can be used successfully for student learning in a context of clear goals, flexible feedback, and supportive communication (Schrenk et al., 2021).

Our English Grammar in Context course started as a two-day campus-based interactive course offered to PhD students in the health sciences. The course content was based on common grammatical problems that we had identified when reviewing samples of students' texts. The main aim of the course was to give participants strategies for writing clearly and concisely and reflecting on their own writing style. Class size ranged from 15 to 25 students. Active learning was promoted through collaborative grammar exercises in small groups, quizzes and analyses of own text, and class discussions.

The Covid-19 pandemic required a change to a fully online course in 2020. Despite our initial doubts, this led to a successful Zoom-based course based on a flipped classroom approach using online pre-class, in-class (in Zoom), and post-class learning activities. After returning to face-to-face teaching, we retained the basic structure from the flipped classroom.

Several previous studies have described blended and flipped learning approaches for academic writing courses or medical school education (Hew & Lo, 2018; El Sadik et al., 2021; Khojasteh et al., 2021), but mostly to compare the outcome of blended learning courses with traditional campus-based learning. They do not describe the process of developing the blended learning course, nor do they report the impact on student motivation and learning of integrating adult and work-based learning into the course design.

The aims of the current research were i) to identify the optimal design for a blended and flipped learning approach to a scientific English course and ii) to investigate the impact of incorporating pedagogical principles from adult and work-based learning on student motivation and learning.

This is an example of educational design research (McKenney, 2016), where the course design has been optimised through three iterative cycles of development with the active involvement of teachers (as practitioners), students, and an e-learning consultant (as researcher).

This article begins by describing the theoretical foundations underlying our teaching approach. This is followed by a description of the methods used to evaluate the course design over its three iterative cycles. The Results section then presents the findings of each iteration in turn and the incremental adjustments made to the course design. In the Discussion section, we summarise the study results with a view to identifying the optimal course design for this English grammar course. It is our hope that this sharing of the final flipped classroom design and our experiences in developing this approach will help other teachers and educators to find inspiration for creating their own blended and flipped learning designs.

Theoretical underpinnings

Blended learning and flipped learning are pedagogical methods that integrate online and face-to-face components. In 'true' blended learning, also known as hybrid learning (Bates, 2016), consideration is given to how online and face-to-face learning activities can best complement each other based on the course's overall learning objectives. Flipped learning, for example via a flipped classroom approach, occurs when the presentation of new content (traditionally conducted in-class) is flipped to become the pre-class or preparation activities of the course. The traditional homework is then transformed into in-class activities focused on interactive and collaborative problem-solving, with the teacher as facilitator. Post-class activities can be incorporated to consolidate the knowledge and skills addressed in the pre- and in-class activities.

The flipped learning approach used in this article is based on the work of Karanicolas et al. (2016), who emphasise the importance of students understanding the coherence between pre-class, in-class, and post-class learning activities in order to foster a high motivation to work with the various learning activities. Based on Bloom's taxonomy, Karanicolas et al. (2016, p. 6) developed a Flipped Classroom Design Template describing the key elements of flipped learning (pre-class, in-class, and post-class). As shown in Table 1, we modified this template to emphasise the links between the various types of class activities and the learning objectives and topics.

Table 1. Template for writing learning activities in Flipped Learning. Modified from Karanicolas et al. (2016).

Bloom's taxonomy	**Learning objectives** Insert the identified learning objectives	**Pre-class** Understand and remember key concepts	**In-class** Analyse key concepts	**In-class** Apply key concepts	**Post-class** Evaluate and create (Assess higher order synthesis of key concepts)
Lesson/Topic/ Module 1	Pre-class: ... In-class: ... Post-class: ...				
Lesson/Topic/ Module 2	Pre-class: ... In-class: ... Post-class: ...				
Lesson/Topic/ Module 3	Pre-class: ... In-class: ... Post-class: ...				
Lesson/Topic/ Module 4	Pre-class: ... In-class: ... Post-class: ...				

Each row represents a separate lesson, topic, or module. When you have identified the learning objective(s) for each row, write in your selected learning activities as pre-class, in-class, or post-class activities. You can add more rows as needed.

Because our course participants are adult (university) learners, we can benefit from the work of Danish educational and learning researcher Knud Illeris, who states that:

> "The generally most decisive factor for significant learning in adults is the requirement for motivation rooted in direct interest, something they feel like doing and are committed to, or a realized necessity, something they have understood and accepted to be beneficial to learn in relation to something they want to achieve." (Illeris, 2000 quoted from Illeris, 2004, p. 162)

An example of this is to use the participants' own research papers as the basis for learning English grammar.

The research field of work-based learning is also relevant as it contains pedagogical perspectives that increase the participants' motivation for the learning activities. The learning activities that the learner uses energy and time to work on should:

> "...derive[...] from the needs of the workplace and the learner rather than being controlled or framed by the disciplinary or professional curriculum: work is the curriculum." (Boud & Solomon, 2001, p. 5)

As writing scientific articles is a key work activity for university researchers, building grammar learning activities around authentic work tasks became a central activity of the course.

These pedagogical principles of direct interest and involvement of current work guided the course design throughout the three iterations. However, the participants' learning experience with these principles was first evaluated after the final iteration.

Methods

The method used in this study follows the overarching principles of educational design research. This methodological approach is characterized by being "... theoretically oriented, interventionist, collaborative, responsively grounded, and iterative", as described by McKenney & Reeves (2012 in McKenney, 2016, p. 155). Educational design research typically unfolds in three phases:

1. Analysis and Exploration: The focus is on understanding the current problem and articulating it from a theoretical, descriptive, and analytical perspective.

2. Design and Construction: This phase involves the construction and description of a preliminary design intended to address the problem.

3. Evaluation and Reflection: Evaluation and reflection on the activities of this phase lead to new ideas for redesign, while the new knowledge generated as a by-product of these activities contributes to a broader theoretical understanding of the field.

Additionally, there is a close collaboration between researcher (author CK in the present case) and practitioner (authors CG and JP), where each typically assumes different roles in the process. The design phase often involves both researchers and practitioners: researchers contribute research-based knowledge to the design, while practitioners provide insightful knowledge from the local context. Researchers also often play a significant role in the choice and application of scientific methods and the subsequent dissemination of knowledge through papers and conferences. The practitioner may be heavily involved in the implementation of design experiments and in the analytical work, as is the case in this study.

We chose the educational design research approach as it fitted directly into our own context of reflecting over the various iterations and interventions during the development of our course.

As is common in educational design research (McKenney, 2016), we used mixed methods for data collection. Thus, we supplemented quantitative data from student feedback questionnaires with qualitative data from focus group interviews and teacher reflections.

We evaluated the course design over three iterations: initial trialling of e-modules in a face-to-face, campus-based course (Iteration 1), the forced change to a fully online course inspired by the flipped classroom (Iteration 2), and the final flipped classroom approach (Iteration 3*)*. Iteration 1 comprised six courses from March 2017 to September 2019, with a total of 109 participants. Iteration 2 comprised seven courses from May 2020 to January 2022, with a total of 128 participants. Iteration 3 comprised six courses from November 2021 to May 2023, with a total of 117 participants.

Student feedback

For each of the three iterations, we analysed participants' responses to a standard evaluation form distributed by the university teaching department after each course. This included questions on the appropriateness of the course organisation, course materials, and teaching methods, the coherence of course contents (all on 5-point Likert scales from Strongly agree to Strongly disagree), level of satisfaction with the course (5-point Likert scale from Very satisfied to Very dissatisfied), and whether they would recommend the course to others (5-point Likert scale from Definitely to Definitely not). Free comments could be added. The response rate to the questionnaire was 93% for iteration 1, 90% for iteration 2, and 83% for iteration 3.

In iteration 1, we held a focus group (Tritter & Landstad, 2020) with four participants from two courses to explore their experiences using one of the e-modules and recommendations for further development. The opening question led to discussion that was followed up by prespecified questions, with the course teachers as moderator (Author 1) and observer (Author 2). The opening question was *How much of the module have you completed and how would you describe your overall impression of the module?* Examples of follow-up questions were: *What did/didn't you like about the module? How easy or difficult was it to navigate through the module? What did you think of the difficulty level in the exercises? Do you think the module could be improved in any way? How would you recommend the module be used?* We also asked questions about whether they would like some of the module to be in video form or to receive a badge, for example, upon completion of a section (gamification).

In iteration 3, we developed an 18-item questionnaire to evaluate the students' perceptions of the course design and learning activities. The items enquired about the usefulness or effect of the Day 1 pre-class (3 items) and in-class activities (3 items), Day 1 post-class and Day 2 pre-class activities (4 items), Day 2 in-class (5 items) and post-class activities (2 items), and a question about the course in general. All items were answered on 5-point Likert scales from Strongly agree to Strongly disagree (Croasmun & Ostrom, 2011). The questionnaire was distributed to course participants by Author 1 via a link to Microsoft Forms at the end of the Day 3, and answers were anonymous.

Teacher reflections

Our reflections on the three course iterations were based on Gibbs' reflective cycle for examining and learning from repeated experiences (Edinburgh, 2023), namely description, feelings, evaluation, analysis, conclusion, and action plan. Taking advantage of the dual teacher presence, we described to each other our experience of each course and our feelings and thoughts. We then evaluated the aspects that worked well and those that worked less well and attempted to analyse the underlying reasons. We concluded what we had learned and determined what actions were needed to improve the course.

The current study did not require ethics approval as it was conducted as part of routine teaching. The participants in the focus group have given permission to use their quotes in the way presented.

Results and reflections

This section presents each iteration in turn, starting with the course design followed by findings from student feedback and teacher reflections on the learning experience, and adjustments to the course design.

Iteration 1: Trialling of e-modules in a face-to-face course

The tasks in the initial two-day face-to-face course were based on pedagogical principles from adult and work-based learning with respect to direct interest and the integration of work and learning as strong motivational aspects supporting participants' motivation. The participants analysed their own text (scientific papers) during the course, and the grammar materials used professional English to ensure discipline-specific instruction that allows the students to relate to the text (Wingate, 2012). It provides the language complexity that PhD students need to master and ensures contextualisation of learning (Gregory & Salmon, 2013). In 2019, we developed an online e-module on Sentence structure as a homework assignment to help students build on existing knowledge. The e-module comprised grammatical explanations and examples accompanied by eight exercises with automated answers and explanatory text.

Student feedback

The standard evaluation form had been sent to all 109 participants of six courses between March 2017 and September 2019 and was completed by 101 participants (93% response rate). See Appendix 1 for graphical results. The face-to-face course was assessed by participants as relevant (99%) and having adequate difficulty level (95%). Most answered 'strongly agree' to the course being organised appropriately in terms of information flow (54%), materials (54%), teaching (63%), duration (48%), and coherence (61%). Overall, 72% of participants were 'very satisfied' with the course, and 84% would 'definitely recommend' it to others. Thirty participants made positive comments, e.g. 'One of the best and most hands-on PhD courses, I have attended'. The 13 participants suggesting improvements mentioned a longer course, more practice with grammar skills, and more opportunity to work on their own texts, e.g. 'To expand the course to further include practical exercises including more work on our own papers'.

The focus group in February 2020 comprised four PhD students who had attended the face-to-face course and then completed the Sentence structure e-module. The overall feedback was positive e.g. 'Liked the explanations before the exercises and I learned a lot', 'Very useful as a refresher after the course', but there were many suggestions for improvement e.g. 'Show the answer to each question right away', 'More examples at the start of each exercise', 'More feedback on incorrect answers' (Table 2).

Teacher reflections

From the participants' comments, we concluded the e-module was a useful supplement as post-class practice activity, and we developed a further e-module on Sentence clarity. We adjusted the e-modules according to the suggestions (Table 2), e.g. indication of time needed, more examples, and feedback on answers.

The participants recommended that we not gamify the e-modules as this could distract their attention, e.g. 'It is about learning, so keep it serious.' This is in line with experiences from an online teaching tool for reflective writing tasks – 'As no grade is given, the user's focus is directed toward learning with regards to the writing task and incorporating reflective elements into their writing' (Lucas et al., 2019).

Table 2. Iteration 1: Student feedback from the focus group (anonymised quotes) on the Sentence structure e-module used in the initial campus-based course.

General set-up	*Suggestions for improvement*
Very useful as a refresher after course. Liked the explanations before the exercises and I learned a lot. Liked the gradual build-up in difficulty throughout the module. Liked the use of scientific language – it was different to learning from a generic grammar textbook and more realistic. Liked the variation in question type – kept you on your toes. Time needed for completion (1-2 hours) was appropriate. It was easy to navigate through the module, and the list of contents was helpful.	Show all questions in an exercise at once rather than one at a time. Show the answer to each question right away rather than at the end of each exercise. Difficulty level was mostly good, but sometimes too tough and sometimes too easy – could divide into basic exercises and advanced (or optional) exercises. Fonts were sometimes inconsistent, which was distracting. More examples at the start of each exercise (there is currently only one example). Say how long each exercise is likely to take.
Explanations of grammar points	*Suggestions for improvement*
No videos – so much is in video now. For me it is much easier to just look at something and use it. I also share an office with three other people, and I don't want to wear headphones. I like to see it in writing. After the face-to-face course, the module should just be in written form.	More feedback on incorrect answers. You can re-read the grammar point, but I would like an explanation for why the answer was incorrect. Could have more feedback about why a particular answer is correct.
Tone	
No badges for achievement, though perhaps a smiley now and again. If there was a little acknowledgement once in a while, it would not hurt me, but badges might remind me of my kid's video games. Do not want to get a score at the end of a module. It is about learning, so keep it serious.	
Suggestions for how the e-module should be used Do exercises as homework to review what was learned in class and for more practice; could then go over some of the issues during class and work on your own text. Some exercises have several possible answers, so discussion in class would be useful. As a 'refresher' – follow-up after the face-to-face course. Make completion of modules a requirement for PhD students to pass the course because so much of their work has to be written in English. Make it available in different formats, e.g. laptops, mobile phone, and iPad, although most likely to be completed using a laptop.	

Iteration 2: Fully online course with flipped classroom

The Covid-19 pandemic required a fully online course in 2020 despite our doubts that we could deliver a course of acceptable quality due to our desire for a 'hands-on' approach with active student participation and open exchange of challenges, errors, and possible solutions. Our solution was to use a flipped classroom approach combining pre-class, in-class, and post-class learning activities (Karanicolas et al., 2016) where participants were introduced to topics at home via online resources (reading, exercises, and a PowerPoint presentation) and in-class learning activities as teacher-guided

practice and discussions via Zoom sessions using PowerPoint slides and breakout rooms (Chen et al., 2017; Dombrowski et al., 2018; Fatima et al., 2017). We developed a third grammar e-module on Nouns and Verbs for post-class activities. The initial result was a two-day course, which was extended in January 2021 to include Day 3 on peer review, see Figure 1.

On Day 1, the morning in-class Zoom session was followed by individual post-class tasks. Initially, the Day 2 pre-class tasks were set for the morning of Day 2, but participants wanted more activities for the Day 1 afternoon, so the pre-class tasks were moved there.

The goals of the Day 1 pre-class assignments were to ensure that all participants knew basic English grammar (nouns and verbs) and were introduced to English sentence types to make the in-class tasks easier. The formats for Day 1 and 2 were designed to i) cover as many of the face-to-face course topics as possible, ii) vary the learning mode (screen time, breakout room discussions, individual work on own text) to encourage active learning, and iii) limit screen time to two consecutive hours to maintain attention and motivation.

<table>
<tr><th></th><th>Pre-class assignment</th><th>DAY 1</th><th>DAY 2</th><th>DAY 3</th></tr>
<tr><td rowspan="2">9.15-12.00</td><td rowspan="4">(1) Complete e-module on ‘Nouns and Verbs’

(2) Watch video on ‘English sentence structure’

(ca. 2 hours)</td><td rowspan="2">Zoom session 1
- Introduction to the course
- 4 types of English sentences

(PowerPoint slides + group-based exercises)</td><td>Zoom session 2
- Sentence length
- Standard English word order</td><td rowspan="2">Zoom session 5
- Introduction to group work
- Group work: reviewing each other’s manuscripts

Review of each manuscript (max. 45 mins each)</td></tr>
<tr><td>Zoom session 3

- Wordiness and removing unnecessary words</td></tr>
<tr><td rowspan="2">12.00-13.30</td><td rowspan="2">TASK 1: Do Exercises 1-3 of e-module on ‘Sentence structure’ (ca. 1 hour)

TASK 2: Work further on sentences in your own text (ca. 30 mins)

TASK 3 (optional): Complete rest of e-module on ‘Sentence structure’</td><td>TASK 6: Wordiness

(ca. 30 mins)</td><td rowspan="2">Zoom session 6
- Q&A
- Course summary and feedback</td></tr>
<tr><td>TASK 7: UK/US English
(ca. 10 mins)</td></tr>
<tr><td rowspan="2">13.30-15.00</td><td rowspan="2">TASK 4: Sentence length (ca. 15 mins)

TASK 5: Standard English word order (ca. 45 mins)</td><td>Zoom session 4
- UK/US English
- Review of grammar topics</td><td></td></tr>
<tr><td>TASK 8: Sharpening your editing skills
- Preparing for Peer review</td><td></td></tr>
</table>

Pre-class learning activities with self-study worksheets and online e-modules

In-class learning activities online via Zoom

Post-class learning activities with self-study worksheets and online e-modules

Figure 1. Final format of the fully online course on English grammar for PhD students in the health sciences (Iteration 2)

Student feedback

The standard evaluation form had been sent to all 128 participants of seven fully online courses between May 2020 and January 2022 and was completed by 115 participants (90% response rate). See Appendix 1 for graphical results. The course was assessed as relevant (100%) and having adequate difficulty level (94%). More participants than before answered 'strongly agree' to the course being organised appropriately in terms of information flow (73%), materials (74%), teaching (81%), duration (65%), and coherence (77%). Overall, 83% were 'very satisfied' with the course, and 90% would 'definitely recommend' it to others.

Thirty-five participants wrote positive comments, e.g. 'Great course with the appropriate amount of lecture and group work – especially when considering it was an online course!' The 19 participants suggesting improvements mentioned a longer course ('there was a lot of information to digest'), a day or two between course days and especially between Day 2 and 3 ('to let what I learned at the course sink in'), and more feedback on own text. Participants found the pre-class activities useful ('Very good with a modul[e] before the course to get a kind of introduction') as well as the extra peer review day ('Keep having the third day, because then it all comes together and you can see what you have learned').

Teacher reflections

We covered about two-thirds of the topics from the face-to-face course and did not go into the usual depth for some topics to avoid many successive small topics with little time for self-reflection or individual student-tutor discussions. A major drawback of the first online course was that we felt we talked too much and dominated the sessions with instructions, rather than having the participants talk and interact. Greater teacher talking time can lead to students finding the teaching less rewarding and appearing not to connect with either the teacher or each other (Wilkinson, 2018).

In the first online course, most participants chose to have their webcams off, making it difficult for us to assess their levels of interest and participation. This was resolved in later courses by requiring all webcams to be on throughout the four Zoom sessions so that participants became comfortable using webcams for screen-sharing exercises.

We made further changes after the first online course:

- At the start of the first Zoom session, we asked each participant to introduce themselves and share what they wanted to achieve from the course. The participants started their webcams for this and then kept them on for the rest of the course. Despite taking 15 minutes of valuable course time, the introductions helped to create a class atmosphere and encouraged active student involvement. Continual use of webcams gave a congenial atmosphere that was more like a physical classroom, and the participants were much more willing to ask questions, make comments, and share examples from their own texts.
- Screen-sharing was enabled so that after creating and editing sentences in the Zoom breakout rooms, participants shared their documents with the whole class. This gave them the responsibility for writing up the answers and controlling the screen, taking an active role in the lesson.
- The PowerPoint presentation on English sentence types was added from the December 2020 course and onwards as a pre-class activity for Day 1.
- Day 3 on peer review was added from January 2021: a half-day where groups of 2-3 participants worked in Zoom breakout rooms to review and comment on each other's texts.

The teachers were present throughout in the main Zoom room and visited the breakout rooms to follow progress and answer queries.

Iteration 3: Blended and flipped classroom

After the Covid-19 pandemic, we returned to a face-to-face course but retained Day 3 as an online activity that followed 1-2 days after Day 1 and 2. The student feedback from iteration 2 led to further additions:

- More e-modules were developed as post-class activities for further practice.
- An in-class exercise on sentence flow
- A quantitative evaluation of the participants' learning from the course: before and again after the course, participants were required to edit a text containing 30 pre-specified grammatical errors. Their 'before' and 'after' edited texts were scored from 0 to 30 to indicate how many errors they had identified.

Similar to iteration 2, the course was designed according to the pedagogical principles and structure of the blended and flipped classroom with a focus on coherence between pre-class, in-class, and post-class learning activities (see Table 3).

The final course format in iteration 3 is shown in Figure 2. Screenshots of the setup on the e-learning platform are shown in Appendix 2.

Table 3. Flipped classroom design used in iteration 3 of the English Grammar course, showing the linkage between course topics, learning objectives, and levels of learning activities. Modified from Karanicolas et al. (2016)

Bloom's taxonomy	Learning objectives	Pre-class Understand and remember key concepts	In-class Analysing key concepts	In-class Applying key concepts	Post-class Applying key concepts	Post-class Evaluate and create
Topic 1: English sentence types	To be able to use the four English sentence types and avoid other types of sentences	E-module on 'Nouns and Verbs' Video on English Sentence types	Identifying subject and verb Identifying compound and complex sentences	Creating compound and complex sentences Assessing own writing style	E-module on 'Who, that, and which' E-module on Sentence types	Editing your own text in light of the day's learning
Topic 2: Sentence length	To recognise overly long sentences and develop strategies for shortening them	Information on sentence length	Analysing sentence length in own text	Combining short sentences and dividing long sentences		
Topic 3: Standard word order	To learn strategies for expressing your intended meaning in English	Information on standard English word order	Exploring effects of word order	Keeping subject and verb close together	Editing own manuscript E-module on Sentence clarity (optional)	Using a checklist to assess one's own writing
Topic 4: Clarity and Wordiness	To learn strategies for writing clear and concise scientific texts		Comparing use of who, that, which Identifying examples of wordiness	Correcting nominalisations Removing unnecessary words	E-module on Wordiness (optional)	Editing own text in light of the course learning
Topic 5: Peer review	To be able to reflect over own writing style To identify key writing concepts	Reviewing the checklist for assessing another person's text		Analysing another person's text and giving feedback Analysing feedback on own text	Task: applying feedback on own text	Editing own text in light of the course learning
Topic 6: Scientific texts in English	To develop confidence in scientific writing in English	Editing an unseen scientific text before the course starts				Editing the same text plus teacher feedback

<table>
<tr><th></th><th>Pre-course</th><th>DAY 1</th><th>DAY 2</th><th>DAY 3 (online)</th></tr>
<tr><td rowspan="2">9.00-15.00</td><td rowspan="3">1) Find a manuscript to work on during the course

2) Complete the pre-course quiz

3) Complete the e-module on Nouns and Verbs

4) Watch the video on English sentence structure</td><td rowspan="2">Introduction to the course

Four types of English sentences

(PowerPoint slides + group exercises + analysis of own text)</td><td rowspan="2">Sentence length

Standard English word order</td><td>Introduction to group work

Peer review in small groups: reviewing each other's manuscripts</td></tr>
<tr><td>Summing up + Feedback</td></tr>
<tr><td>Home work</td><td>Meaning and clarity
Removing unnecessary words
US/UK English</td><td>TASK 6: Complete the post-course quiz</td></tr>
<tr><td></td><td>TASK 1: Who, that, which e-module
TASK 2 (optional): Sentence structure e-module</td><td>TASK 5: Sharpening your editing skills (preparing own text for peer review)</td><td></td></tr>
<tr><td></td><td>TASK 3: Sentence length
TASK 4: Standard English word order</td><td></td><td></td></tr>
</table>

Pre-class learning activities with self-study worksheets and online e-modules

In-class learning activities – campus based with physical presence

In-class learning activities online via Zoom

Post-class learning activities with self-study worksheets and online e-modules

Figure 2: Final format of the blended and flipped classroom design for the English grammar course.

Student feedback

The standard evaluation form had been sent to all 117 participants in six flipped classroom courses between November 2021 and May 2023 and was completed by 97 (83% response rate). See Appendix 1 for graphical results. The course was again assessed as relevant (100%) and having adequate difficulty level (96%). More participants than before answered 'strongly agree' to the course being organised appropriately in terms of information flow (76%), materials (85%), teaching (89%), duration (75%) and coherence (87%). Overall, 96% were 'very satisfied' with the course, and 100% would 'definitely recommend' it to others.

Thirty-two participants made positive comments without suggesting any improvements, e.g. 'Great with test and quiz before the beginning of the course, and very good with many exercises during the course'. The 10 participants suggesting improvements mainly referred to Day 3—some would have preferred an in-person approach, while others recommended use of Google docs to share texts or to revise each other's papers as homework before meeting on Day 3. The focus of the learning activity needs to be emphasised to the participants, e.g. 'We spend to[o] much time on [clarifying] the aim of each other's studies rather than concentrating on the text/grammar'.

To gain a deeper understanding of the participants' learning experiences with iteration 3, participants were given an 18-item questionnaire directed at the pedagogical method flipped classroom with the integration of pedagogical principles from adult and work-based learning. Of the 26 participants in the May 2023 course, 25 completed the questionnaire. Results from selected items are shown in Figures 3-12. See Appendix 3 for further results.

Relevance of pre-class learning activities (Figures 3 - 5):

Pre-class activities have a low difficulty level in Bloom's taxonomy so that they can be solved independently by the participant. We found that 92% of respondents agreed or strongly agreed that the pre-course quiz was a good balance between a challenging task but an opportunity to practise editing a scientific text. All respondents agreed or strongly agreed that the Nouns and Verbs e-module helped them learn the fundamentals about the topic. '...I really liked all the little quizzes. They were very informative.' Regarding the PowerPoint video, 88% agreed or strongly agreed that this helped them prepare for the teaching on Day 1. The video was perceived as 'Short and concise. Great prep for class.' However, one respondent commented: 'Unnecessary video when attending your class, but it was short, so it was okay.' Redundancy should be avoided in pre-class and in-class activities.

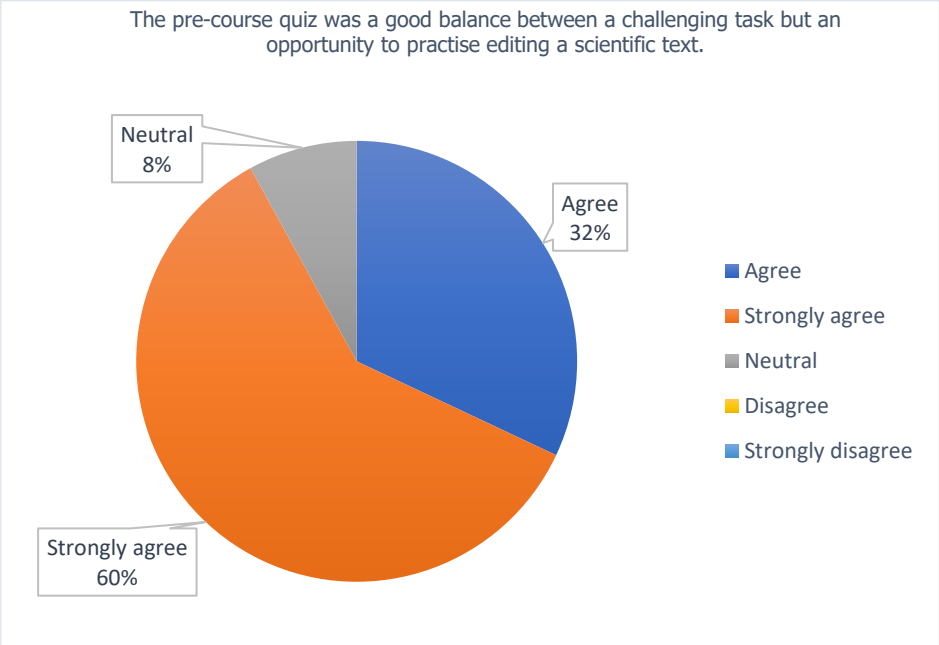

Figure 3. Relevance of pre-class learning activities: pre-course quiz (n=25 respondents).

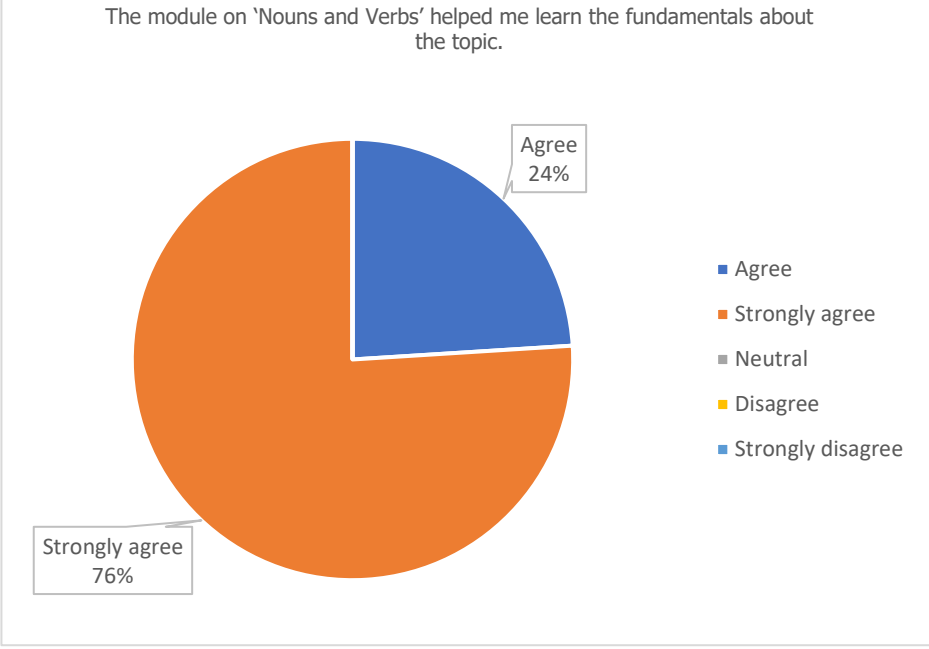

Figure 4. Relevance of pre-class learning activities: e-module (n=25 respondents).

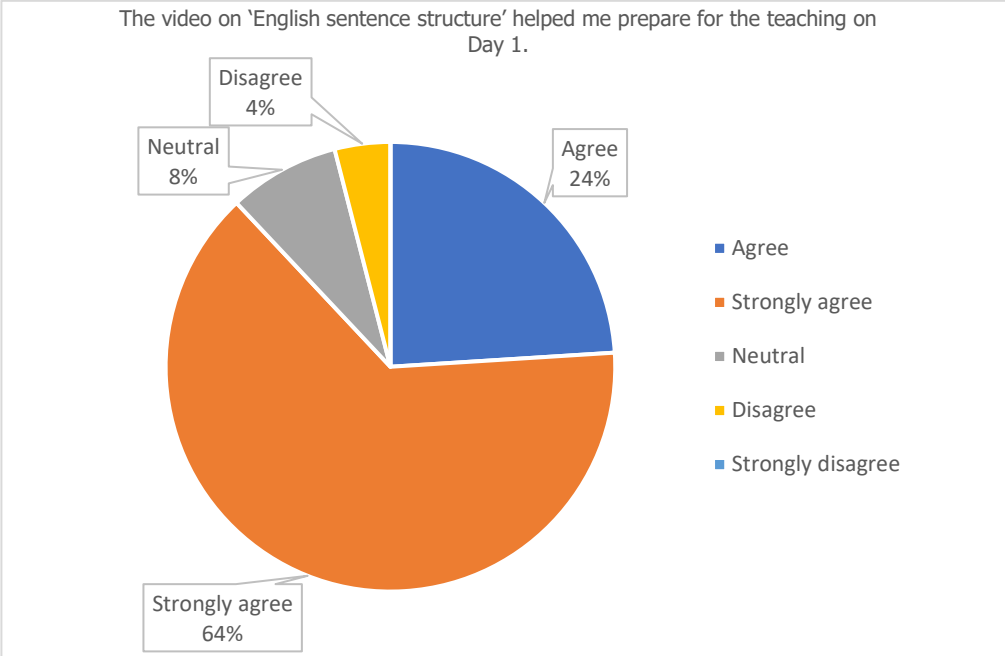

Figure 5. Relevance of pre-class learning activities: video (n=25 respondents).

Relevance of in-class group learning activities (Figures 6 - 7):

In the flipped classroom approach, collaborative in-class activities are expected to be beneficial for learning. It was therefore interesting to know if the participants experienced that the in-class group activities contributed to their learning. We found that all respondents agreed or strongly agreed that the group exercises were useful practice in applying rules about sentence types and that group work contributed to their learning. However, some respondents added that they would like additional (individual) exercises to work on in-class because they finished quickly.

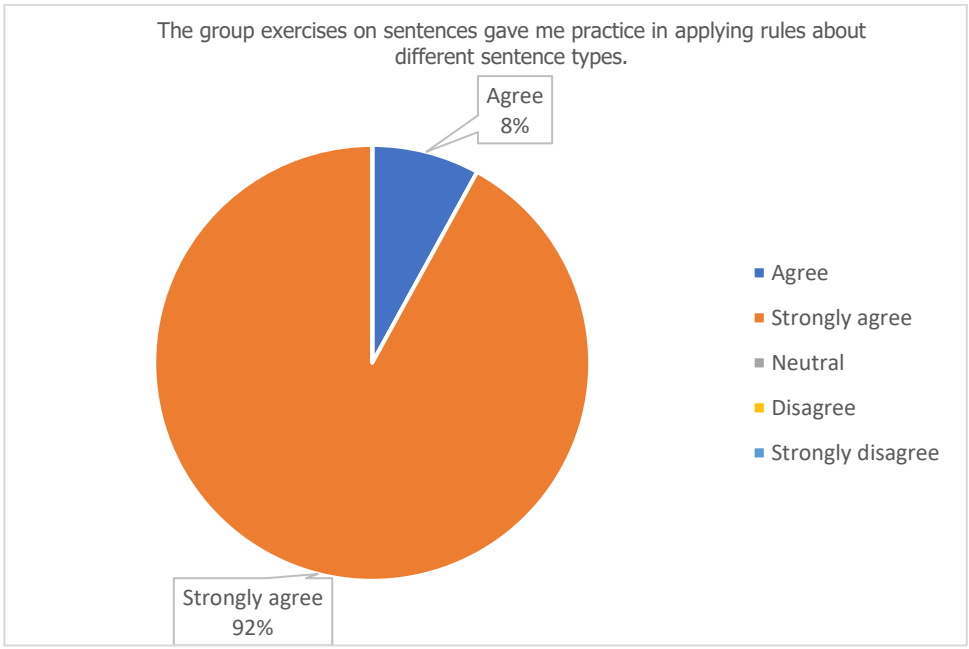

Figure 6. Relevance of group exercises as in-class learning activities (n=25 respondents).

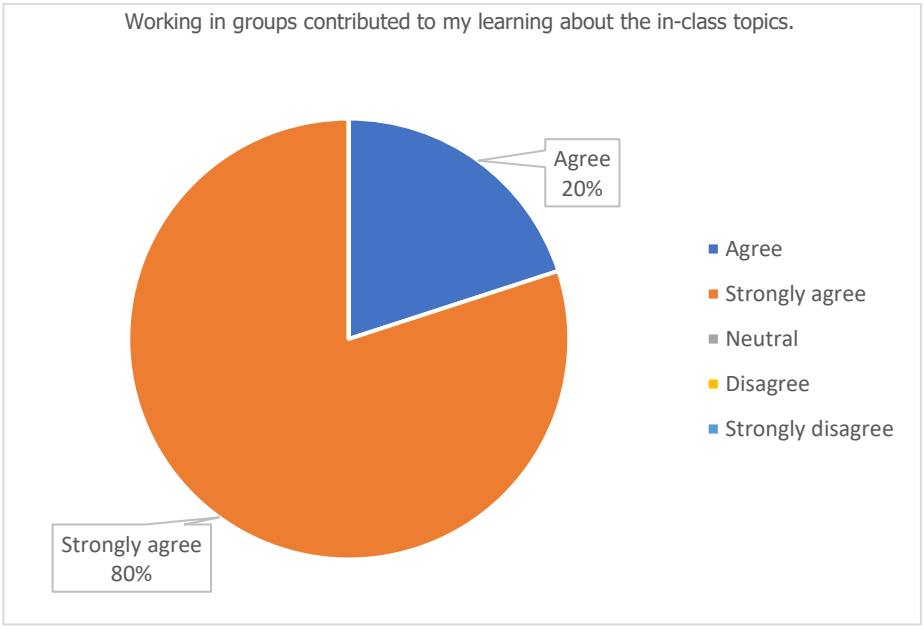

Figure 7. Relevance of working in groups for in-class learning activities (n=25 respondents).

Relevance of post-class learning activities (Figure 8 – 10):

Regarding the homework e-module 'Who, that, which', 92% of respondents agreed or strongly agreed that it helped them consolidate their knowledge from the in-class activities. In addition, all respondents agreed or strongly agreed that the homework task on sentence length helped them recognise aspects of their own writing style. Similarly, all respondents agreed or strongly agreed that the homework task on English word order helped them apply a grammar rule to their own writing.

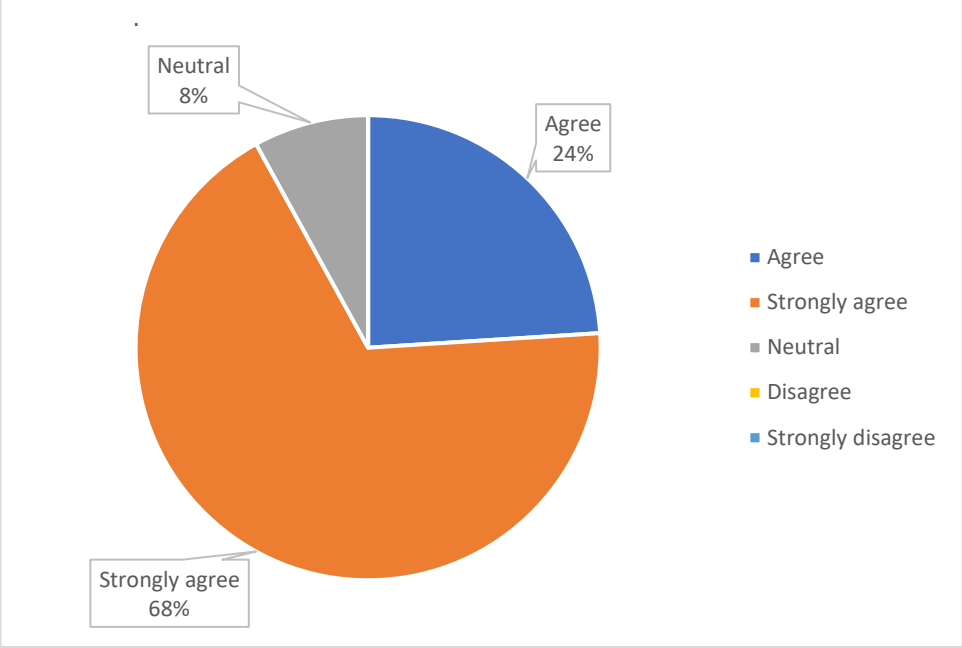

Figure 8. Relevance of post-class learning activities: e-module (n=25 respondents).

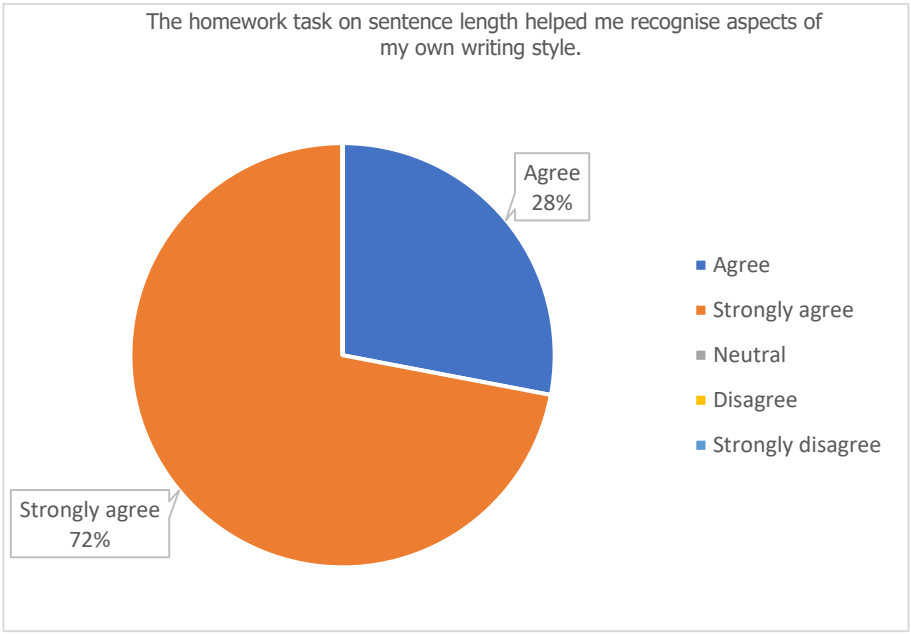

Figure 9. Relevance of post-class learning activities: sentence length (n=25 respondents).

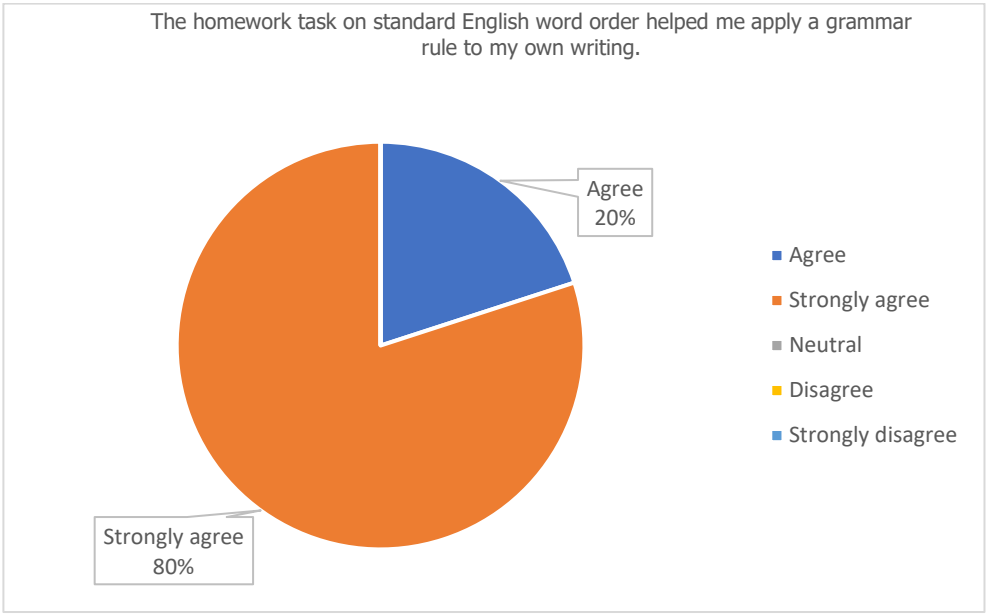

Figure 10. Relevance of post-class learning activities: standard English word order (n=25 respondents).

Pedagogical principle of direct interest and integrating own work and learning (Figure 11 - 13):

Having participants use their own texts in course activities was an important element, and it was expected to be a motivating learning activity. We found that 96% of respondents agreed or strongly agreed that working with one's own text in class was a motiving aspect. As stated by one respondent: 'Nice way [to] practice the learned skills in real life.' Similarly, 88% of respondents agreed or strongly agreed that editing one's own text in preparation for peer review was highly relevant for their work (Figure 11). One respondent commented:

> It was highly relevant for my work as I got a first experience with revising my own text using the tools you have taught us. The list you provided helped me to focus at one aspect at the time.

All respondents agreed or strongly agreed that the course activities had helped them prepare their own texts (Figure 12). One respondent commented: 'It was very nice to be able to apply what we have learnt in class on my own text.'

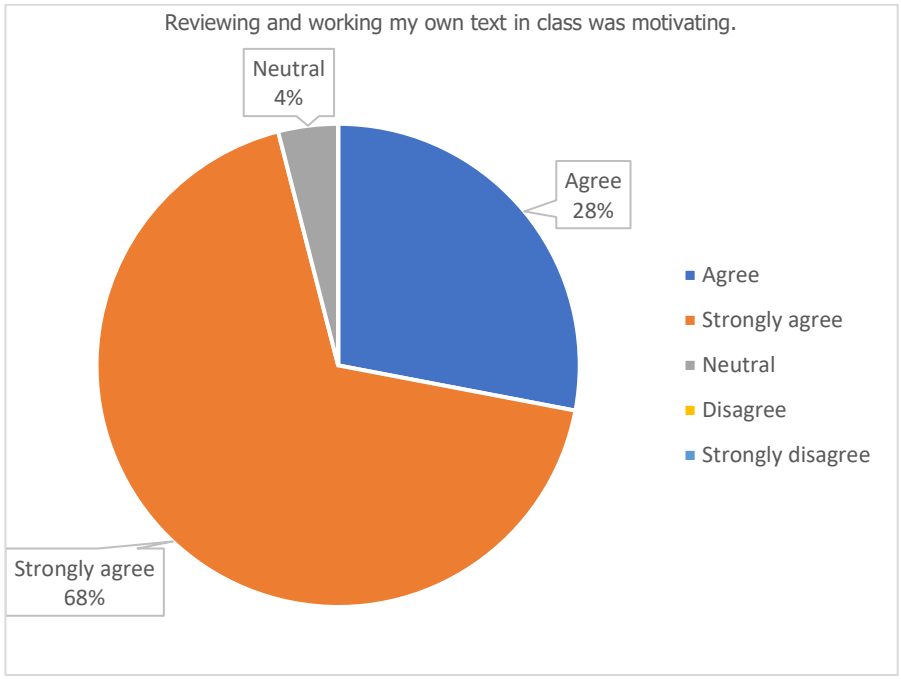

Figure 11. Relevance of integrating own work and learning: own text (n=25 respondents).

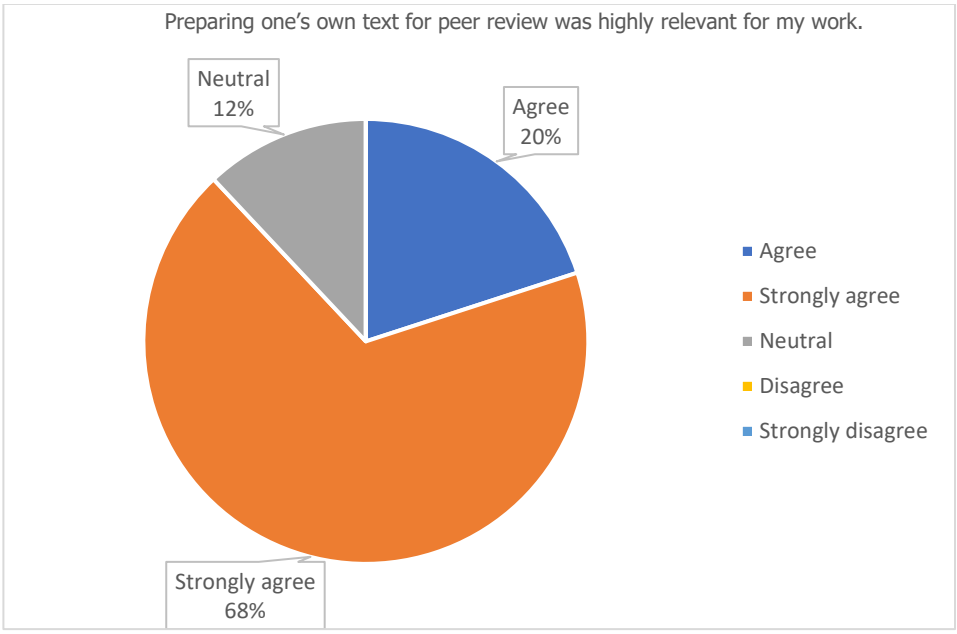

Figure 12. Relevance of integrating own work and learning: peer review (n=25 respondents).

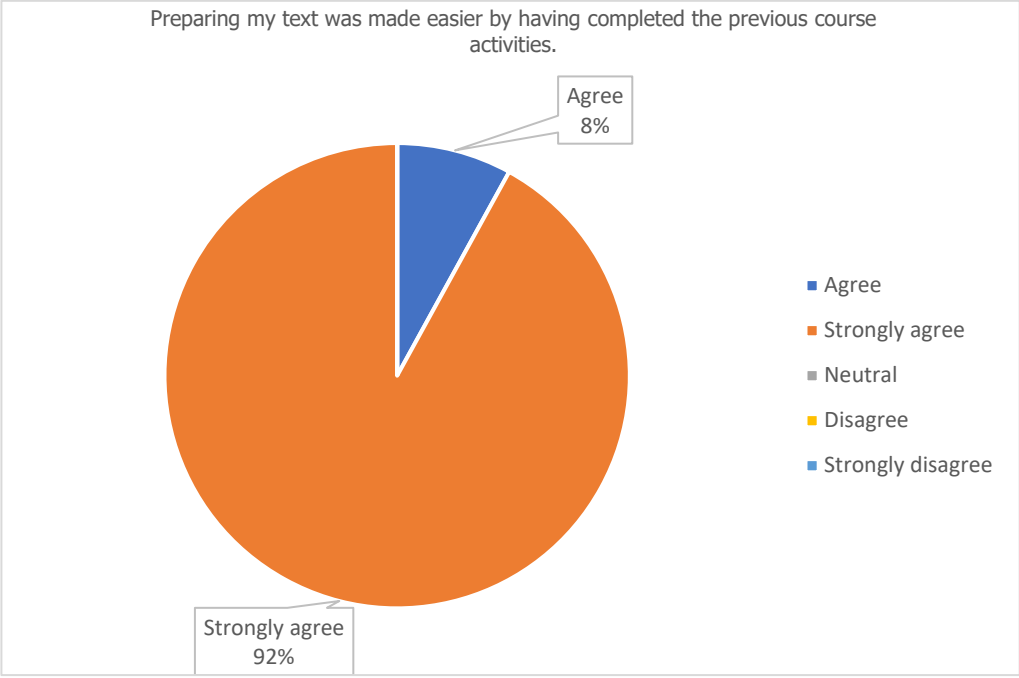

Figure 13. Relevance of integrating own work and learning: course activities (n=25 respondents).

Teacher reflections

Compared to our initial course in iteration 1, we felt the course with e-modules and flipped classroom offered a greater variety of techniques and formats and was more interesting for all involved. The students were more active as they needed to complete pre-class e-modules and had to prepare for peer review, which they mostly ran by themselves using a checklist prepared for them.

The quantitative assessment of student learning showed that for the 54 participants who edited both pre- and post-course texts in the four courses between December 2022 and May 2023, the median score improved from 13 (range 3-23) to 18 (range 11-27). The 48 participants who initially scored 20 or under showed greater improvement (median score improving from 12 to 18) than the 8 participants scoring 21 or over (median score improving from 22 to 23).

Discussion and pedagogical implications

In this educational design research study, we found that the optimal design for our scientific English course was the blended and flipped classroom approach as used in iteration 3. Incorporation of pedagogical principles from adult and work-based learning through authentic work tasks and use of participants' own texts allowed direct application of new knowledge and maintained motivation.

The results of the standard evaluation form showed that participants were increasingly satisfied with the course, from iteration 1 (face-to face, campus-based approach based on adult and work-based learning) to iteration 3 (blended learning based on the pedagogical method of flipped classroom). Their assessment of the course improved on all parameters enquired about.

The questionnaire responses related to the flipped classroom and the pedagogical principles of adult and work-based learning showed that participants reported very positive learning experiences. They found the pre-class activities helpful and relevant to the in-class activities, which in turn were assessed

as having high learning value. The post-class activities supported participants' learning as they were perceived to effectively reinforce comprehension and retention of the in-class content.

The participants' questionnaire responses, where 96% of respondents agreed or strongly agreed that working with one's own text (authentic work task) in class was a motiving aspect and 88% of respondents agreed or strongly agreed that editing one's own text in preparation for peer review was highly relevant for their work, lead us to believe that the activities based on adult and work-based learning were strong motivating factors in promoting active and engaged learning and the participants' competence in academic English writing skills (Lea & Street, 2006). This observation aligns with our quantitative assessment that demonstrated an improvement in the participants' editing skills. We conclude that learning activities where participants engage with their own and colleagues' texts help to elicit 'direct interest' and support the integration of work and learning.

Further refinements in course design

The evolution of the course was greatly helped by the constructive feedback from the course participants via the standard evaluation form and the focus group. We can identify several strategies that could further improve our course design and can be recommended to others:

- Some participants prefer an in-person approach on Day 3 (peer feedback activity) instead of the online Zoom meeting. An alternative could be the HyFlex approach (Beatty, 2019), where participants can participate either from a classroom setup or online via web-conference platforms such as Zoom or Teams.
- Day 3 was added because participants wanted a longer course and more time to work on their own texts. It has proved useful in helping participants consolidate their learning. As one participant commented: 'Keep having the third day, because then it all comes together, and you can see what you have learned'. We can recommend such a follow-up day where participants can practice applying their newly acquired knowledge and skills.
- Day 3 is usually one or two days after Days 1 and 2 so that participants can digest the course information before peer review. As those new to a flipped classroom might perceive an increased study load, pre-class activities need to be accompanied by clear instructions and explanation of the pedagogical intentions and relevance to the learning experience. The scope of pre-class activities will depend on the participants' needs and available time and their ability to see the potential benefit from the learning activities.
- A consistent request from participants in the three iterations was for additional individual and collaborative practice tasks—either online or in-class. Teachers should prepare extra pre-class, in-class, and post-class activities so participants can work with these by themselves or in groups. We now open all our e-modules to participants at the end of the course to broaden their learning experience.
- Regarding online sharing and reviewing of documents, participants suggested a platform such as Google docs for a smooth handling of feedback in peer review learning activities. Our university does not allow Google docs, so alternatives could be Microsoft OneDrive or Teams Rooms.

From iteration 2 with the fully online version of the course, we learned the importance of helping participants feel comfortable with the use of webcams and screen-sharing functionalities in web-conference platforms such as Zoom. Starting the course with a less formal activity where the participants introduced themselves via voice and webcam helped to build participants' confidence in using webcams. The screen-sharing assignments also supported participants in learning the necessary skills to become competent online learners (Christensen et al., 2016).

Limitations of our study include the small sample sizes and postgraduate level of the course. Our participants are more familiar with scientific writing and with collaborative work than undergraduate students would be, and our small class sizes support participants in being active and visible, for example, by having the Zoom webcam on. Although the same two authors taught the courses and ran the focus group, the standard evaluation was run independently, and a third author (not involved in the teaching) was involved in designing and interpreting the 18-item questionnaire.

Conclusion

Based on the findings from this study, we conclude that a learning design based on a blended and flipped classroom and the pedagogical principles of adult and work-based learning have significant value and benefit for participants learning scientific English grammar. We found that learning activities where participants engaged with their own and colleagues' authentic texts, which constitutes a key work task for PhD students, helped to elicit 'direct interest' and supported the integration of work and learning.

The blended and flipped learning approach used in iteration 3 appeared to be the optimal course design for the purposes of this scientific English grammar course. The explicit focus on the coherence between pre-class, in-class, and post-class activities helped ensure relevant and motivating learning activities, while incorporation of participants' own texts allowed direct application of new knowledge and maintained motivation.

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