# Joint online distance learning to complement postgraduate pathology training in preparation for national board examinations

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## ABSTRACT

**Aims** To meet the flexible learning needs of pathology residents preparing for national board examinations, a joint distance learning approach was developed using both asynchronous and synchronous activities with whole slide images, drawing on empirical educational research on online distance learning.

**Methods** In a case study of an implementation of the designed joint distance learning approach with a geographically dispersed group of pathology residents in Finland, the participants' perceptions were measured with a 12-item questionnaire covering the value of the learning opportunity, the quality of the sociocognitive processes and their emotional engagement and social cohesion. Communication during the online session was also recorded and analysed to provide objectivity to the self-report data.

**Results** The effectiveness of joint online learning for knowledge acquisition and preparation for national board examinations was highly rated. However, despite strong emotional engagement during synchronous activities, participants reported minimal interpersonal interaction, which was also reflected in the recordings of the online session.

**Conclusion** Using a technology integration framework and guided by the principles of self-determination theory, joint distance learning is emerging as a beneficial addition to postgraduate pathology programmes in preparation for national examinations. However, to realise the full potential of interpersonal interaction, participants should be prepared for an appropriate mindset.

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**WHAT IS ALREADY KNOWN ON THIS TOPIC**

⇒ Although organising multi-institutional teaching activities digitally and remotely seems a logical option for postgraduate medical education, it is still underused.
⇒ The evaluation of the online distance learning formats by the staff and the trainees shows a very mixed picture.

**WHAT THIS STUDY ADDS**

⇒ Using a technology integration framework and guided by the principles of self-determination theory, joint online learning opportunities are highly valued by residents in preparation for national board examinations.
⇒ To realise the full potential of interpersonal dynamics in joint online learning opportunities, participants need to cultivate a mindset conducive to meaningful interaction.

**HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY**

⇒ In order to determine whether joint multi-institutional online learning approaches are a serious option for national pathology societies to incorporate as a regular part of their residency programmes, further experimental studies and qualitative studies on the promotion of appropriate attitudes to online interpersonal interaction are needed.

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## INTRODUCTION

It is often a challenge for individual postgraduate pathology training institutions to provide each resident with the optimal learning experiences necessary to pass the examinations for board certification. In some countries, such as Finland, the board examinations are national, but similar challenges apply to institutional or international examinations. Although several pathology curricula have been described in the literature, particularly in the USA, and the Accreditation Council for Graduate Medical Education has established overarching guidelines for pathology residency training, there remains a wide variety of curricula in different institutions.[1] [2] In essence, pathology residency training has remained more of an apprenticeship than a curriculum, with the inherent limitation of knowledge gaps that can vary significantly between training programmes.[1]

In addition, it is difficult for any single postgraduate medical education (PGME) programme to cover the rapid and ever-evolving technical developments in pathology diagnostics, where, for example, laboratories need to adopt digital pathology for their diagnostics[3] and the number of biomarkers available to a pathologist is increasing every day.

In PGME, on the other hand, the residency and fellowship programmes often have common core requirements that make joint teaching a viable option in terms of content. Since 2023, the common core requirements in pathology training in Finland have been defined as entrustable professional activities (EPAs). These EPAs include the ability to perform a medical autopsy, to chair a

multidisciplinary meeting, the general ability to examine surgical resection specimens, to perform frozen section procedures and specified skills and knowledge in all major subfields of surgical pathology.

However, co-organised, face-to-face extra-institutional teaching activities—such as educational pathology conferences, visiting lectureships or resident study groups—often do not fit into everyone's schedule, are time consuming and expensive to attend or organise. Organising such collaborative teaching activities digitally and remotely therefore seems a logical option, especially for distant institutions. It offers young professionals with a full time job and busy social lives, the flexibility of avoiding travel and tuning in from distributed clinical sites or from home, making a valuable contribution to a better work-life balance.

An important prerequisite for such computer-mediated solutions is the availability of online teaching materials and familiarity with their use. As virtual microscopy, that is, computer-based digital slide viewers, has been used in pathology education and certification examinations for many years,[2] this seems to be a minor issue for pathology education. Nevertheless, prior to the COVID-19 pandemic, the use of digital pathology and whole slide imaging (WSI) as an educational tool for distance teaching remained underused.[4] During the social distancing measures in response to the COVID-19 pandemic, however, distance learning opportunities for pathology residents outside of their daily practice received a huge boost. A recent literature review by Hassell *et al*[5] gives a nice overview with lists of the many online resources such as cases, atlases and other websites for all stages of pathology education. However, to the best of our knowledge, an organised combination of asynchronous and synchronous online activities has not been described in the literature for the PGME context.

During the COVID-19 pandemic, there was no choice but to work and study remotely. However, now that conditions have returned to normal and the choice between face-to-face and online distance learning has been restored, it is interesting to explore how the compulsory move to distance learning during the pandemic has affected current attitudes towards this option for teaching pathology residents.

The studies described in the literature present a mixed and conflicting picture in this regard. An online survey of pathology trainees,[5] programme directors and faculty assessing the use of and response to various digital pathology modalities before and after COVID-19 revealed a perception—held fairly equally by the majority of faculty and trainees—that the move to online modalities had led to a reduction in the quality and effectiveness of pathology teaching and learning. However, a review of 51 papers on remote not workplace-based learning in PGME, in response to COVID-19, found that learners were largely satisfied with online learning and reported mostly positive responses.[6]

The latter Best Evidence Medical Education (BEME) systematic review also provides some guidance for educators seeking to optimise learning in their postpandemic practice, stating that future online distance education would benefit from: (a) considering technology integration frameworks, (b) leveraging collaborations and (c) underpinning their developments with learning theories.

In response to the aforementioned need for flexible and easily accessible supplementary learning opportunities for pathology residents, and in line with the recommendations of the BEME guide,[6] we developed and piloted in a multi-institutional collaboration, using the PICRAT framework and underpinned by self-determination theory (SDT)[7]—an online learning opportunity to prepare pathology residents for a national board examination. After the pilot, we assessed the residents' perceptions of the value of the learning opportunity, the quality of the social-cognitive processes during the joint online debriefing, and finally their emotional engagement and social cohesion during this debriefing.

## METHODS
### Collaboration, educational theory and technology integration framework

We brought together the five university hospitals with PGME pathology programmes in Finland (Helsinki, Kuopio, Oulu, Tampere and Turku), which are geographically far apart, in an online multi-institutional collaboration. As SDT states that autonomy, competence and relatedness are the three basic cognitive needs that are essential for building intrinsic motivation to learn[7] and have also been shown to be useful for distance histopathology education,[8] we addressed these needs to stimulate residents' engagement in a joint online distance learning activity to prepare for their national board exam.

Autonomy (feeling that one is the source of one's own behaviour) was particularly addressed in the preparatory asynchronous work, which could be completed independently, at one's own pace, regardless of time or place. Competence (feeling effective in one's actions) and relatedness (feeling connected to others) on the other hand were particularly addressed in the synchronous debriefing session, where peers from different institutions met online and were supported by two experienced pathologists who had a good idea of the residents' level of knowledge from the products of their preparatory work.

As a framework for technology integration, we used the PICRAT framework,[9] which was also used in the systematic review by Khamees *et al*.[6] It is designed to explore the extent to which teachers have integrated technology and facilitated learner engagement in online learning implementations. In doing so, the PICRAT framework can also provide us insights into how to improve teaching and increase learner involvement in online distance learning developments.

PIC in the PICRAT framework stands for passive, interactive and creative and describes a learner's relationship to technology. It refers in part to the Interactive, Creative, Active, Passive (ICAP) framework,[10] which assumes that different kinds of cognitive engagement bring about different levels of understanding. Passive engagement (P) would produce knowledge that can be recalled verbatim. Active engagement (A) would produce a body of knowledge that can be applied to similar contexts, whereas constructive or creative engagement (C) would result in knowledge that can be applied to a novel context. Finally, interactive student engagement (I) would result in a knowledge base that allows partners to invent new ideas.

RAT in PICRAT framework stands for replaces, amplifies or transforms and describes a teacher's use of technology. In amplifying, the use of technology goes beyond replacement, because it enables the learner to achieve their learning outcomes more effectively and/or efficiently. In transforming, technology enables learning outcomes that would not have been possible without it.

During the development and implementation of the online distance learning opportunity for pathology residents, we sought to fulfil especially the creative, interactive, amplifying and transforming factors of the PICRAT framework.

### Procedure

The online learning opportunity consisted of two phases: asynchronous individual work followed by synchronous group work (figure 1). The individual work required residents to view eight short clinical vignettes with WSI tissue samples and to answer accompanying questions. In terms of PIC classification, the
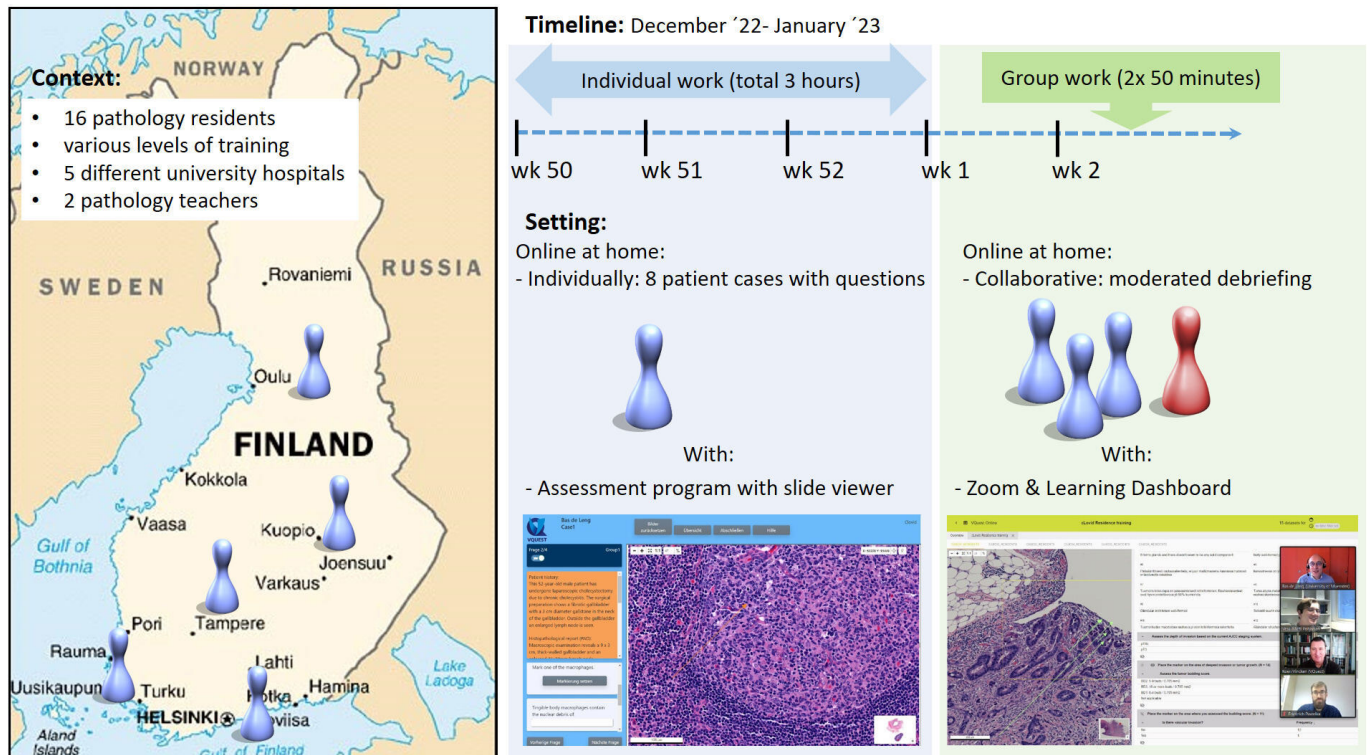
**Figure 1** Overview learning opportunity (note: the figure is a compilation of images from https://commons.wikimedia.org/ with source: CIA, The World Factbook, 2004 and screenshots from our software programs).

residents' engagement with the technology was *creative*, as they had to submit their answers to a variety of question types (free text, multiple choice, marker and long list) in an online assessment programme that allows visualisation and manipulation of large WSIs (VQuest; http://vquest.eu/).

In a subsequent joint debriefing session, the collected responses from the preparatory work were displayed in a shared learning dashboard[11] and discussed in a video conference (Zoom meeting) moderated by two pathology teachers. This made the residents' relationship with the technology also *interactive*.

The teachers' use of technology was for both the individual preparatory assignment and the group debriefing in part *amplifying* and *transforming*. Free text and multiple choice questions can be implemented on paper, but with used technology the collection, aggregation and reporting of responses can be enhanced and done in real time. Moreover, for marker questions, where the answers are placed inside the WSI and can then be displayed in a hotspot diagram, the used technology is essential.

The asynchronous individual work on eight cases in VQuest is been done in the last 3 weeks of December 2022. The synchronous moderated joint debriefing using Zoom and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses learning dashboard was scheduled for the second week of January 2023. Each of the moderating pathology teachers developed four cases from their practice, one using only text-based questions (multiple choice, long menu and open text) and the other using a combination of text-based and marker questions (marker placed within the WSI). Neither residents nor teachers needed to instal any special software as everything could be accessed through a standard browser.

To ensure a degree of anonymity during the Zoom debriefing, participants were given login names that only revealed their university hospital and year of training; as the Zoom session was also recorded, the webcams were disabled for participants.

In contrast, the two pathology teachers who moderated the debriefing and the two persons who technically supported the session were visible via their webcam.

### Measures
Residents' perceptions of both asynchronous individual preparation and synchronous joint online debriefing were assessed using a questionnaire with 12 statements to be answered on a 7-point Likert scale (table 1). Each of the aspects: learning value (items 1–4), quality of sociocognitive processes (items 5–8), emotional engagement and social cohesion (items 9–12) were covered by four items.

The four items for the quality of sociocognitive processes (eg, discussion) were selected from the 'Heedful Interrelating in Collaborative Educational Settings' scale,[12] a 6-item questionnaire that measures participants' perceptions of the quality of interactions during collaborative educational tasks. For emotional engagement, items from 'emotional engagement' questionnaire by Dao and Sato[13] were used.

### Data collection and analysis
Residents who were able to participate in both parts of the learning opportunity were asked to complete an online questionnaire (LimeSurvey) anonymously, immediately after the joint online debriefing. Means and SD per item were calculated for these responses. Participants' verbal and chat activity during the Zoom session was also recorded in order to have a means of objectifying self-reports of online discourse.ob

### RESULTS
Sixteen pathology residents participated in the asynchronous individual work, while eight of them also participated in the subsequent joint online debriefing session. The latter eight came from four different Finnish university hospitals, ranged from the

**Table 1** Residents' perceptions of the supplementary learning opportunity

| Scores were expressed on a 7-point scale in which 1='not at all true' and 7='very true' | | N=8 | |
|---|---|---|---|
| Learning value | **Asynchronous preparation** | **Mean** | **SD** |
| | 1) The individual work on the patient cases contributed to my knowledge on microscopic pathology. | 5.13 | 1.25 |
| | 2) The individual work on the patient cases is a good preparation for our national specialist exam. | 6.13 | 0.99 |
| | **Joint synchronous debriefing session** | | |
| | 3) The participation in the joint debriefing contributed to my knowledge on microscopic pathology. | 6.33 | 0.52 |
| | 4) The participation in the joint debriefing is a good preparation for our national specialist exam. | 6.00 | 1.15 |
| Quality sociocognitive processes | 5) I asked other participants to elaborate on their ideas so that I could make sure I understood what they were saying.* | 1.33 | 0.82 |
| | 6) I carefully explained a concept to other participants who did not understand the concept.* | 1.40 | 0.89 |
| | 7) I carefully contributed relevant examples during the online session.* | 2.40 | 2.19 |
| | 8) I tried to think about how I could connect my ideas to ideas expressed in the online session.* | 4.50 | 1.87 |
| Emotional engagement and social cohesion | 9) I was interested in the interaction.† | 5.38 | 1.41 |
| | 10) I was not anxious during the interaction.† | 4.75‡ | 1.39 |
| | 11) I enjoyed the interaction.† | 5.00 | 1.29 |
| | 12) I felt part of a learning community. | 4.71 | 1.11 |

*Item from HICES scale.
†Item from 'emotional engagement' questionnaire.
‡Reversed score because the original statement was worded in a positive way.
HICES, Heedful Interrelating in Collaborative Educational Settings.

first to the third year of their residency training; all responded to the online questionnaire.

Table 1 shows the residents' scores on the questionnaire that assessed the following aspects of the learning opportunity: learning value (items 1–4), quality of sociocognitive processes (items 5–8), emotional engagement and social cohesion (items 9–12). The mean scores for the learning value of both parts were all above 5 on the 7-point Likert scale. The scores for emotional engagement and social cohesion were all around 5, but three of the four scores for the quality of sociocognitive processes were well below 3.5.

## DISCUSSION AND CONCLUSION

Although online collaborative teaching seems to be a logical option for additional learning opportunities in pathology PGME programmes, this option remained underused prior to the COVID-19 pandemic,[4] and even after the pandemic the appreciation of this option shows a mixed picture in the literature.

In contrast to the PGME context, the use of a combination of asynchronous and synchronous learning opportunities during the COVID-19 pandemic has been described in the literature for undergraduate and graduate pathology teaching[14–18] (table 2). What is unique about the use of this combination in

the study described here is that the individual performances in the preceding asynchronous activities were archived with digital slides so that they could later be discussed in detail in the group during the synchronous activities.

As the characteristics of online distance learning programmes are important for their evaluation, we designed and implemented a joint online learning activity following the recommendations of the BEME guide,[6] using the PICRAT framework as the technology integration framework and SDT as the learning theory.

This case study evaluated the implementation of this joint online learning approach for a distributed group of pathology residents preparing for a national board examination.

The results indicated that the residents highly valued the joint online learning opportunity in terms of knowledge acquisition and preparation for their national examination. This was confirmed by the significant positive responses to the open questions, with residents regularly asking for more such teaching opportunities. However, although they were highly emotionally engaged in the 2-hour synchronous activity, they perceived little interpersonal interaction. This was confirmed by the analysis of the screen-recordings and chat-recordings of the session, in which there was little to no interaction—apart from some verbal

**Table 2** Joint online distance learning during the COVID-19 pandemic for different stages of pathology education

| Study | Participants (type and number) | Topic | Communication type and technology use | Task and activities |
|---|---|---|---|---|
| Balakrishnan et al[14] | Attending pathologists (8) and trainees (8) Multiple institutions | Breast pathology | Only asynchronous: email, Google Classroom, MS PowerPoint, static microscopic images | Ordering pathology tests and making a differential diagnosis based on a clinical vignette Provision requested info and follow-up discussion on differential iagnosis and literature |
| Sundling and Kraft[15] | Postgraduate: fellows and residents | Cytopathology | Synchronous: Zoom video conference using chat, screen sharing, annotation and recording Digital slides with one-plane focus | Answering questions with annotating of host screen |
| Parker et al[16] | Graduate medical students (20–25) | Organ systems pathology | Asynchronous: individual preview of digital slides in PathPresenter (later to be presented to their peers) Synchronous: Zoom video conference with annotation function and screen sharing, MS PowerPoint and digital slides with PathPresenter | Clinical case presentations by teachers for large groups (20–25 students) during which questions could be posed and answered with the annotations on the presenters' screen. In small-group work (10–13 students): students present digital slides to their peers and workup as a group a challenging case by ordering tests (for which they receive the results) and finally present a diagnosis |
| Samueli et al[17] | Graduate medical students (59) | Diagnostic (surgical) pathology | Asynchronous: digital slides via remote desktop access, Moodle quizzes Synchronous: Zoom video conference with recording | Individual online quiz (asynchronous) Mutual online review of the quiz (synchronous) |
| Sharma et al[18] | Undergraduate medical students (220) | Histopathology | Asynchronous: canvas quizzes with static microscopic images Synchronous: MS teams video conference, MS PowerPoint templates, digital slides | Clinical cases. Team-based learning with one instructor for 5–6 teams. Individual quizzes, team work (5–7 students) in which microscopic images are captured, annotated and filled in the templates |

discussion between the two teachers and a few chat messages. This is a pity because such interpersonal interaction has the potential to engage residents deeply, making their thinking visible and providing an important opportunity to deepen knowledge through argumentation and to discuss misconceptions.[19]

Well-known inhibitors of interaction, such as disinterest or anxiety,[20] do not seem to play a role here. Both teachers also regularly encouraged active participation from residents with questions, so it seems that the prerequisite that participants enter the online session with a mindset, in which the aim is to grow in knowledge together through constructive interpersonal interaction,[21] is missing. As the pilot project took place entirely in a Finnish context, cultural factors may also have played a role. For example, a cross-cultural comparison study of asynchronous online collaboration showed differences in the behaviour of Finnish, American and Korean participants.[22] It may not have helped that the participants did not know each other and the webcam was turned off for privacy reasons. In addition, the online session was advertised as a debriefing session, which may have led to the expectation that teachers would mainly discuss the cases covered.

Despite the obvious limitation of having relatively few participants and a specific geographical context, it is safe to conclude that joint online distance learning based on a technology integration framework and on principles of SDT are a welcome and instructive addition to PGME pathology programmes. However, in order to take advantage of the valuable role of interpersonal interaction for learning, participants should be prepared for an appropriate mindset.

For small groups of learners who have never met in person, short icebreaker activities, such as sharing personal photos of hobbies or pets that are being discussed, can facilitate social interaction in general.[15] In addition, separate targeted introductions could also help to raise awareness of the effectiveness of collaborative learning and the importance of having the right mindset for it. One might consider knowledge about how individual performance goals are related to the regulation of learning in groups.[23]

In order to determine whether the joint multi-institutional online learning approach described in this study is a serious option for national pathology societies to incorporate as a regular part of their residency programmes, future research on the approach with larger numbers and in different geographical contexts would be welcome.

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