Adrian Tomey, UZHHOROD NATIONAL UNIVERSITY, adrian.tomey@uzhnu.edu.ua
Kristof Tomej, UNIVERSITY OF SOUTHERN DENMARK, krto@sdu.dk

Improving Knowledge Integration in Medical Education through Creative Tasks: Addressing the Challenges Exacerbated by the War in Ukraine

ABSTRACT

Knowledge integration is a common challenge in medical education, but its importance is even more pronounced in times of crisis and prolonged disruption of the educational process. In this article, we explore how the use of creative and generative teaching and learning activities, including presentations, drawing association maps, role-playing, and video production, influences students' knowledge integration in a medical degree programme in Ukraine that has been affected by the ongoing war in the country. By analyzing students' responses to reflection prompts and the teacher's notes, we found that using these activities made the students' learning process more visible to other students and the teacher, relieved some of the pressure on the students, and encouraged students to form learning communities. At the same time, the unfamiliar nature of these activities can reveal new sensitivities in students. The application of these activities also requires more preparation time and concentration on the part of the teacher. Based on our findings, we propose that creative and generative activities are particularly flexible in helping to support knowledge integration in both academically well-performing and weaker-performing students. We also suggest that their contribution to maintaining meaningful social relationships between students is particularly important in times of disruption caused by external factors.

KEYWORDS

knowledge integration, medical education, disruption, creative activities, creative pedagogies

INTRODUCTION

Knowledge integration is a key challenge in medical education. During their studies, future doctors and other healthcare professionals cover a vast amount of material, which is constantly increasing as medical science advances (Green et al. 2016; Wartman and Combs 2019). They are then expected to apply this diverse and typically fragmented knowledge, acquired rapidly over many years of study and across different disciplines, to the clinical reasoning of specific and complex cases while also drawing on knowledge of communication and human behaviour as well as practical and clinical skills (Loftus 2015). However, the outcome is not always as expected, and the fragmentation of medical knowledge in the context of its increasing complexity and other societal pressures can lead to errors and misunderstandings among medical students, as well as poorer well-being (Morcos and Awan 2023; Södervik, Mikkilä-Erdmann, and Chi 2019).

The challenge of integration is exacerbated when the teaching and learning process is further fragmented by disruptions beyond the control of the students, teachers, and even educational institutions, such as during the Covid-19 pandemic and its related restrictions between 2020 and 2022 (Connolly and Abdalla 2022). Following the Covid-19 pandemic, Ukraine experienced even more pervasive disruptions caused by Russia's full-scale military invasion, which

began in February 2022. Even educational institutions further away from the front lines have been affected by frequent air raid alerts (between 500 and 600 hours in the western regions of Ukraine by March 2024), the threat of missile and drone attacks, and other consequences of war, including power outages, military mobilisation, loss of loved ones, and general anxiety and stress (Mayer et al. 2023). As a result, several cohorts of medical students in Ukraine—future doctors and healthcare professionals—have received most, if not all, of their education during periods of instability and frequent disruption.

The war-related educational disruptions have manifested in cancelled academic sessions; longer breaks between learning sessions; sub-optimal ways of delivering knowledge, such as replacing hands-on learning experiences with online learning or self-study; inability to access learning materials due to power and internet outages; poor learning conditions due to lack of electricity, water and/or heating. Constant stress also undermines the learning capacity of the students themselves; a recent study found that nearly 15% of adult civilians in Ukraine had probable post-traumatic stress disorder (PTSD) and 44% had depressive syndromes one year after Russia's invasion (Wang et al. 2024). While some knowledge gaps are expected in any student or graduate, the likelihood and magnitude of these gaps are plausibly higher under these circumstances. At the same time, institutional efforts to adapt to these conditions, such as curriculum integration, require time and resources that are lacking in wartime (Schwartzstein et al. 2020; Vergel, Stentoft, and Montoya 2017). All in all, this leaves the issue to individual educators and students.

This article describes a Scholarship of Teaching and Learning (SoTL) inquiry into how Ukrainian medical students' ability to integrate existing and new knowledge during the ongoing war can be supported with creative and generative[1] teaching and learning activities, such as poster-making, video-making, and role-playing. While such active learning activities, often described as creative pedagogies, are not new to higher education, they are less common in medical classrooms, where traditional didactics centred on reading, summarizing and testing are prevalent (Augustin 2014). They can also be seen as a variation of inquiry-based learning with a particular emphasis on the creative aspects—an educational strategy in which the acquisition of knowledge is driven by the students themselves and which is gaining ground in medical education (Verma, Yacob, and Kirpalani 2023). In the context of this specific inquiry, however, both creative pedagogies and inquiry-based approaches are rare in the curriculum, which is otherwise dominated by traditional didactics.

The aim of this article is twofold. First, to identify specific ways in which creative and generative activities promote medical students' knowledge integration in the context of a protracted war in the country. Second, to identify practical aspects of teaching practice that support or constrain their effectiveness and feasibility.

KNOWLEDGE INTEGRATION IN MEDICAL EDUCATION

The importance of integration in medical education can be explained by the fact that both students and educators are challenged by the ever-increasing amount of knowledge required of qualified medical professionals and the fragmentation of this knowledge (Buja 2019; Majumder, Haque, and Razzaque 2023; Shelton, Corral, and Kyle 2017). Densen (2011) estimated that medical knowledge was already doubling every 3.5 years in 2010, though the pace accelerated in subsequent years. This estimate represents both factual and procedural knowledge in different biomedical and clinical sciences. In addition, medical students are expected to learn about communication with patients and colleagues, as well as other considerations for working in the healthcare sector of a particular country (Kopel, Brower, and Culberson 2021; Loftus 2015). Some medical schools address this issue through curriculum integration, the transformation of a collection of disparate and fragmented subjects into an integrated curriculum (Laksov, McGrath, and Josephson 2014; Loftus 2015; Schwartzstein et al. 2020; Vergel, Stentoft, and Montoya 2017).

However, students themselves are crucial subjects in the integration of knowledge, and therefore pedagogical efforts should also facilitate and support their integrative abilities (Loftus 2015).

There are different views on how individuals integrate knowledge, but the process is commonly associated with the related concepts of deep learning and meaningful learning (Chipamaunga and Prozesky 2019). In this context, knowledge integration can be described by three key characteristics: a) it occurs through higher order thinking, b) it involves making conceptual links, and c) it relates to personal contexts. Higher order thinking means non-routine active cognitive processing (Lewis and Smith 1993). More specifically, Vogel and Hunecke (2024) found that students' knowledge integration had a significant positive relationship with analogical reasoning and perspective taking. Analogical reasoning allows one to identify similarities and differences between concepts, while perspective taking allows one to combine them, even if they come from seemingly contradictory or different perspectives, allowing for a more multi-dimensional, holistic understanding (Vogel and Hunecke 2024). Together, analogical reasoning and perspective taking can optimize the learning of large amounts of information by making connections between different pieces of knowledge and contexts (Chipamaunga and Prozesky 2019). What makes a piece of information or a connection between different pieces meaningful depends on subjective relevance (Chipamaunga and Prozesky 2019; Loftus 2015). This highlights the subjective nature of integration, where students' personal experiences play a crucial role.

These three characteristics contrast sharply with rote learning, the traditional approach to learning in medical education, which is based on repetition and memorisation and is particularly disconnected from students' personal experiences (Azzam and Easteal 2021). Instead, knowledge integration aligns more with active learning methods that promote creativity and critical thinking (Rodríguez et al. 2019). Because it requires higher-order thinking, active learning is quite difficult and demanding, does not occur automatically, and requires some form of support or facilitation. For example, the establishment of meaningful links is often supported by concept mapping techniques (e.g. Pintoi and Zeitz 1997; Rendas, Fonseca, and Pinto 2006). Furthermore, collaboration with others plays an important role in developing creativity and perspective taking skills (Rodríguez et al. 2019).

This points to the potential for educators to set up activities that address several of the characteristics of knowledge integration (Chipamaunga and Prozesky 2019). These activities can include student-produced texts and videos, role-playing, and other creative and generative (in the sense of constructing meanings) collaborative projects (Rodríguez et al. 2019). However, much remains unclear about how these approaches can be integrated into existing medical programmes and courses without losing the benefits of proven, traditional teaching approaches — and without placing additional burdens on students and educators (Buja 2019).

THE CONTEXT OF THE INQUIRY

The structure and approach to medical education in Ukraine is similar to that of many other European countries. Since 2005, Ukraine has followed the Bologna Process, which aims to harmonize higher education across European countries (Mayer et al. 2023). A detailed overview of medical education in Ukraine is provided by Remez (2022). The duration of medical education is six years, equivalent to 360 European Credit Transfer and Accumulation System (ECTS) credits. The first two years are devoted mainly to fundamental science, while from the third year onwards the focus is on clinical subjects. To complete their training, students must pass the Objective Structured Clinical Examination (OSCE) and the Unified State Qualification Exam (USQE). The USQE consists of an English proficiency test and the standardized Krok-1 and Krok-2 (meaning Step-1 and Step-2 in Ukrainian) exams, similar to the United States Medical Licensing Examination Step-1 and Step-2 tests. Krok-1 is taken after the third year of study and focuses on fundamental disciplines (biology, biochemistry, physiology, anatomy, etc.). Krok-2 is taken after the sixth year of

study and covers clinical disciplines, as its questions contain clinical situations with a list of possible answers, of which only one is correct.

The SoTL inquiry took place in the spring semester, which lasted from January 2024 to June 2024, and centred on sixth year (twelfth semester) medical students at Uzhhorod National University, a medium-sized public university in Zakarpattia, the westernmost region of Ukraine. As the university was geographically distant from the front lines, it could continue with traditional face-to-face teaching during this period. However, air raid alerts and other war-related factors still disrupted the process, as discussed in Mayer et al. (2023). During the students' final year, teaching is divided into cycles, with each cycle dedicated to a specific clinical discipline. The duration of the cycle depends on the discipline and the student's chosen specialisation. Students participate in the cycles in small groups of five to 10 students. The first author led the cycle on "Differential Diagnosis in Paediatrics" during the time of the inquiry. The cycle consists of a variety of activities focused on both theory and practice that are designed to prepare students for their Krok-2 and OSCE exams.

This SoTL inquiry and article are the result of a collaboration between two generations of university educators within the same family, working independently in distinct educational environments in Ukraine and Denmark. Adrian Tomey, the first author, is the teacher who experimented with the teaching and learning activities to facilitate skills integration for medical students. As a senior medical educator with almost 30 years of experience, he is relatively new to working with creative tasks. He began experimenting with creative and generative teaching and learning activities in 2020–2021, during the Covid-19 pandemic, when much of his teaching took place online or in hybrid formats. Kristof Tomej, the second author, has about 10 years of experience teaching university students in the social sciences and humanities, using a variety of teaching methods, but no experience in medical and health sciences. The collaboration began with an informal exchange about their experiences with different teaching approaches in different contexts and developed into a SoTL inquiry in the spring of 2024, the methodology of which is described below.

METHODOLOGY OF THE INQUIRY

The SoTL inquiry consisted of the implementation of creative and generative teaching and learning activities in the "Differential Diagnosis in Paediatrics" cycle taught by the first author, and the collection and analysis of student and teacher reflections on their implementation. During the semester, three groups of students participated in the cycle, referred to as groups one, two, and three. Table 1 shows the size of each group, which varied between nine and 10 students, and the time of their cycle. All groups followed the "internal medicine" specialisation, making the curriculum identical for all students. Each cycle lasted three weeks.

Table 1. Descriptions of the three groups of students involved in the inquiry

Group	Number of students	Month	How reflections were captured
Group 1	10	January	Reflection prompts given at the end of the cycle.
Group 2	9	February	Reflection prompts given at the end of the cycle.
Group 3	10	March–April	Reflection prompts given after the first day, after the first week, and at the end of the cycle.

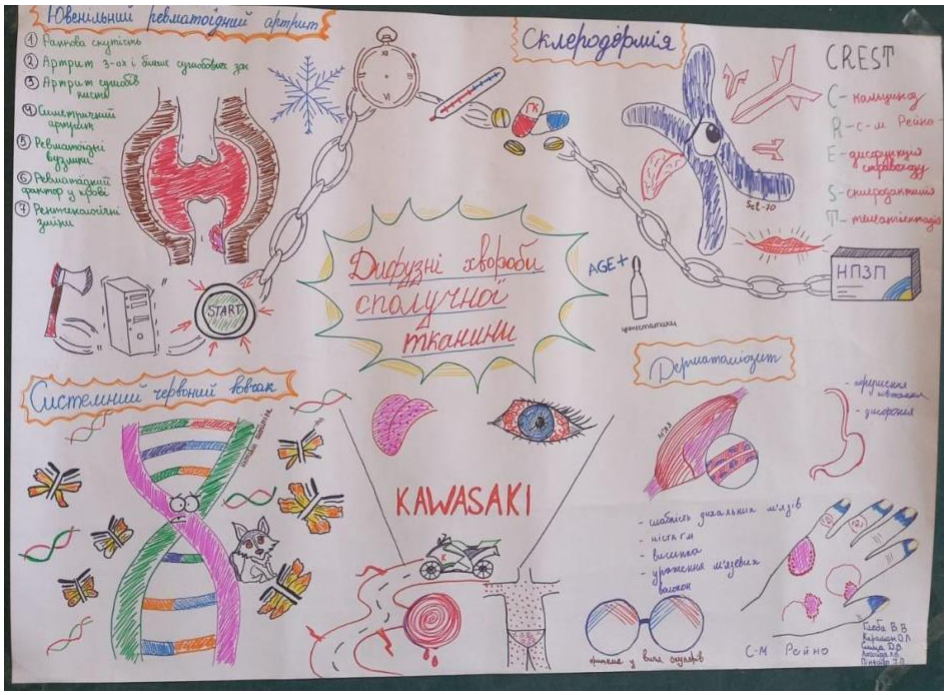
All three groups participated in the same four teaching and learning activities, as described in Table 2. The students chose their teams or partners and carried out all activities collaboratively. The teacher would actively encourage students to form teams based on compatibility and diversity of skills and abilities rather than pre-existing friendships or personal sympathies. As the teacher in

the cycle, Adrian Tomey developed, introduced, and facilitated all activities, while Kristof Tomej was not involved in the teaching process and had no contact with the students.

Table 2. Descriptions of the teaching and learning activities used in the inquiry

Teaching and learning activity	Short description	Rationale
Presentation in pairs (for example, on the topic "A differentiated approach to the treatment of excoriation in children in outpatient settings")	Students were required to work in pairs and prepare a presentation, limited to four slides, on a topic given by the teacher. The main focus was on selecting and prioritising key information from a vast amount of existing knowledge and resources. The preparation of the presentation took place outside contact hours, while the presentation itself took place in the classroom.	The purpose of this activity was to activate the students and to prepare them for the activities that follow. The task required students to quickly review, filter, and select information that addressed the most important aspects of an issue. In the tasks, students were integrating existing knowledge with newly acquired (researched) knowledge.
Drawing association maps on posters (for example, on the topic "Diffuse connective tissue diseases")	The teacher provided a topic to each group of students. They were asked to prepare a short oral presentation on the topic, with the assistance of an association map, which they were instructed to draw on a paper poster. An association map is a form of concept map in which the different elements are based on free associations. In other words, an association map is drawn as a non-verbal guide and support for an oral presentation on the topic. One of the association maps produced by the students is shown in Figure 1.	The use of association maps encouraged students to structure and prioritize their knowledge and to consider alternative perspectives on the information they already had (with the help of each other's free associations), which intended to promote the creation of new conceptual links. In addition, the use of association maps facilitated the retention of information and could be used in other academic and non-academic contexts.
Role-playing a clinical scenario (for example, on the topic "Differential diagnosis of pneumonia in older children. Situation: Pneumonia complications")	Students were required to complete this activity in small groups. The teacher provided a scenario comprising a clinical situation, including roles (e.g., patient, parent, treating doctor, ambulance doctor, experts, etc.), a setting (e.g., the patient's home, ambulance car, emergency room, hospital department, etc.), and the patient's characteristics and symptoms. The students in the group were to role-play this scenario, based on their knowledge. The other students and the teacher observed and provided feedback.	The purpose of this activity was to allow students to apply their knowledge in realistic and holistic situations. It integrated clinical knowledge with tacit and practical knowledge, as students needed, among other things, to administer the necessary medical documentation in each scenario. Role-playing was used to highlight potential communication barriers between different actors.
Producing a video on a given topic (for example, on the topic "Differential diagnosis of glomerulonephritis in children")	The teacher gave each team of students a topic to present by producing a short educational video. The aim was to encourage students to find unusual and creative formats to communicate the topic to a wide audience.	By producing a video, students were required to consider not only the content (based on both existing and newly acquired knowledge) but also the way in which it was communicated. This should help them to memorize complex information and to consider issues from different perspectives.

Figure 1. One of the association maps produced by the students on "Differential diagnosis of systemic connective tissue diseases and systemic vasculitis in children" (Photo by Adrian Tomey, 2024).



Note to Figure 1: In this association map, the students associated the onset of connective tissue diseases in children with a blow (trigger, "axe") to the system ("computer,") which triggers ("start button") a "chain" of interrelated processes in the patient's body, followed by the development of individual nosological forms with their own characteristics that allow for diagnostic search, differential diagnosis, and timely treatment. For example, Kawasaki disease was associated with a "motorcycle" (inspired by the brand of the same name) racing along a "winding road" (blood vessels), making "potholes" (aneurysms of small blood vessels that are a consequence of the disease); heliotrophic rash (periorbital edema) in dermatomyositis–with "tinted sunglasses"; systemic lupus erythematosus–with butterflies, etc.

After participating in these activities, the teacher asked the students to reflect on their experience of the cycle, focusing on the specific teaching and learning activities. We used reflection as a more appropriate approach to capturing knowledge integration than testing students on the presence or absence of knowledge, which is more aligned with rote learning. Reflection itself is seen as a process of learning and, more importantly, a process of understanding one's learning in context, emphasising the connections between different aspects of a practice (Allen et al. 2018). We chose guided reflection through the use of reflection prompts and questions for two reasons. First, Sturgill and Motley (2014) found that guided reflection led to more analytical and integrative reflections. Second, as reflection is not a common activity for students in the Ukrainian education system, we expected that students would need support and guidance throughout this process. The two authors developed these reflection questions collaboratively. The English translations of these questions can be found in the Appendix.

The teacher informed students that responding to the prompts was voluntary and anonymous and would not result in extra credit or otherwise affect their assessment in this or any other course, in accordance with the protocol approved by the faculty's ethical review board. Students were also free to leave responses to some or all of the reflection prompts blank. We asked groups one and two to respond to the reflection prompts only once, after they had completed all the creative tasks and received their grade for the cycle. In order to capture deeper nuances that might disappear over time, we gave group three the reflection prompts three times—after the first day, after the first week, and at the end of their cycle. The last prompts also included a question

about the reflection prompts themselves, as we recognized that responding to the prompts could also play a role in knowledge integration.

Despite the voluntary nature of the reflection activity, all students present on the reflection question distribution days agreed to respond to the prompts and submitted their handwritten reflections. This could be explained by the perceived authority of the teacher and the power relations involved. However, students were aware that their anonymous reflections could not affect their grade or that they could submit a completely blank paper (some students chose not to respond to some reflection questions). More likely, students perceived the reflection activity as another creative activity similar to the others used in the cycle, which, as discussed later in the article, the students generally received well.

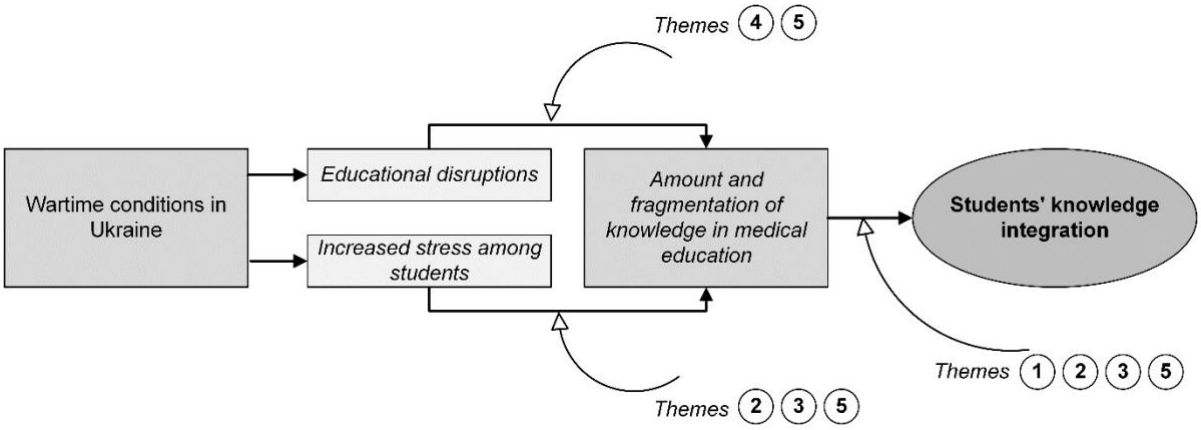
In addition to the student responses, the first author also noted his own observations and thoughts regarding the use of the creative and generative activities as a teacher. In these notes, which he took throughout the semester, he identified the students' informal oral responses, including those voiced after submitting the reflections.

For the final step in the inquiry, the two authors together analyzed the students' reflections and the teacher's notes using thematic analysis. We followed the reflexive thematic analysis approach, described by Braun and Clarke (2019) as an interpretive method of analysis that focuses on generating "patterns of shared meaning" rather than coding reliability. Specifically, Kristof first conducted open, inductive coding, informed by the literature on knowledge integration, and proposed the initial themes. This process was manual and did not involve the use of qualitative analysis software. Each generated theme came from both the students' reflections and the teacher's notes. Next, the two authors had iterative discussions in which they re-evaluated the initial themes in the empirical context. This enabled us to generate themes that were deeply embedded in the context of the inquiry, what Braun and Clark (2023) described as "meaning-based interpretive stories" (2) rather than "topic summaries." While such findings are not as easily generalizable as those from quantitative research, they are not reductionist in nature and therefore capture unique relations within the specific context. Thus, by conducting a reflexive thematic analysis of the students' reflections and the teacher's observations, we generated five themes, which are described below.

THEMES IN RELATION TO THE CHALLENGES OF THE STUDY CONTEXT

As the existing literature shows, the typical characteristics of medical education, such as the amount and fragmentation of knowledge in the curriculum, challenge knowledge integration. However, these effects are exacerbated by the impacts of an ongoing war—both in terms of educational disruptions and stress levels among students. Our SoTL inquiry generated five themes that illustrate different ways in which the use of creative and generative teaching and learning activities has promoted knowledge integration for students. Each of these themes addresses one or more of the challenges to knowledge integration in the context studied, as illustrated in Figure 2. We discuss these themes in more detail below. It is important to note that the students' evaluations and teacher's notes didn't explicitly mention the context of war, which is easily explained by the fact that after two years of full-scale war, it had become part of the Ukrainians' reality rather than a consciously recognized or highlighted factor. At the same time, it is possible to deduce the impact of war conditions from the background information provided in the introduction.

Figure 2. Visual representation of how the generated themes (numbered) address specific challenges of knowledge integration in the context of the inquiry.



Uncovering the students' learning process (theme 1)

Whereas rote learning and other traditional forms of preparation for the final exams, such as Krok-2, are usually carried out independently by students, with only their learning materials and notes, the creative tasks enabled both the students and teacher to observe the learning process as it unfolded. In particular, the association maps and the role-play would reveal students' detailed understanding (or misunderstanding) of concepts and reasoning, rather than just the simple answer to a question. This was particularly helpful in identifying and immediately addressing any gaps in knowledge or possible misconceptions that students might be carrying over from their previous studies or might be developing in this cycle. In their reflections, the students mentioned how much they appreciated how the teacher provided feedback and feedforward not only on their final submissions, but also while they were working on them. As one student in group three wrote: "When the teacher started to critique our creative work, it finally clicked!". The teacher also noted that he could be "part of the learning process." He provided comments and corrections while the students were doing the role-play, allowing them to adapt on the go and make new conceptual links within specific contexts.

As well as interacting with the teacher, the students also observed and responded to how their peers engaged with the tasks. Even when working together outside the classroom on the presentations or videos, students were able to notice and compare each other's understanding, leading to a more thorough search for the correct answer in cases of discrepancy. Sometimes the students themselves would identify and address the gaps in their knowledge as they actively engaged in the activities. For example, a student in group two wrote about the role-play: "I really appreciated the emphasis on the importance of paying attention to the children. The children themselves show you and point out the problems." Looking at issues from different perspectives enabled new knowledge needs to be uncovered.

Importantly, the more transparent learning process also suggested that both generally well-performing students and those who tended to struggle more would benefit from the creative activities. While some students wrote that the activities helped them to "fill in some holes in their existing knowledge" or "refresh knowledge from all years of education," others—likely more advanced students—saw value in using their knowledge in new contexts and understanding question specifics they had not thought of before. The teacher noted that some of the best presentations of associative maps were made by students who did not necessarily have strong prior theoretical knowledge, as some managed to draw visual associations that simply and clearly supported their narrative, rather than relying on the text captions and complex illustrations some other students relied on. Thus, it can be argued that the applied creative activities allowed for

multiple ways and approaches to complete them and provided space for experimentation and the creation of new conceptual links for students with different backgrounds and abilities.

Reducing the pressure on the students (theme 2)

Almost all students described the creative and generative activities as fun, enjoyable, and interesting. The teacher observed similar reactions from the students in their informal comments during the classroom sessions. In particular, the drawing of association maps and the production of videos stood out from the usual way of learning in the programme. As one student in group three wrote: "What I appreciated the most was that the lessons took place in a playful way, which helped me a lot to *adapt*" (emphasis added). The playful aspect was important for knowledge integration because the increased stress levels experienced by students, due to the war, the immediacy of the exam, and the general uncertainty about the future, can limit the mental resources necessary for the higher order thinking required for integration. In particular, the fact that the students learned together most of the time took away some of the uncertainty about whether they were doing well enough with their studies. Both the students and the teacher mentioned that taking part in these activities boosted the students' confidence, which could be explained by the flexibility allowed by the tasks.

At the same time, the reduction of pressure on the students in the creative activities came somewhat at the expense of the teacher, who found this approach more intensive and time-consuming. While the tasks are generally more open and flexible for the students, they require the teacher to prepare in advance by framing the tasks and matching them to the curriculum and the students' existing knowledge levels, as well as staging the tasks with well-developed instructions, materials, and spatial and temporal set-up. The role-play activity in particular requires considerable preparation, including realistic scenarios and role descriptions, and input materials, such as medical records and test results. As the course of students' participation and responses is unpredictable, it also means that the teacher must remain focused throughout the task and be ready to provide feedback, support, and recommendations on relevant issues. In other words, the use of such activities requires more effort from the teacher, which is invisible to the students. It also makes the teacher vulnerable, as it reduces their control over the flow of the teaching and learning process.

The element of surprise (theme 3)

Not unexpectedly, many students indicated that participating in the types of exercises listed in Table 2 was a first for them during their university studies. "I was surprised by the creative tasks. I have never seen anything like this at the Faculty of Medicine," wrote a student in group two. Another student in the same group wrote that the most memorable task during the cycle was the production of the video "because there were no such tasks during the six years of study so far." Novelty was clearly one of the reasons why students found the activities motivating, and motivation is usually a scarce resource among final year medical students, especially in the context of a protracted war. One student in group three mentioned this explicitly: "I was surprised that we had to draw a poster, and it fascinated me and made me very interested in finding information [for the poster]." While the whole purpose of sixth year cycles, such as the one studied in this inquiry, is to consolidate the knowledge acquired in previous years of study, a lack of motivation is often a hindrance at this stage, and the unexpected nature of the learning activities provided a much-needed boost.

At the same time, not being used to such activities also challenged students. Some students mentioned difficulties in completing the creative tasks within the given time frame and expressed a general uncertainty about their work quality. The teacher noted the initial dissatisfaction or perplexity expressed by the students when they first heard about the creative tasks. One student in group two also noted their "initial refusal" to complete them. For many of the

students, the last time they had been involved in drawing was in primary school. Nevertheless, they quickly adapted and became so actively involved that it was sometimes difficult for the teacher to stop them. “They often refuse even to take a break or get very upset if the process has to be interrupted, for example because of an air raid alarm” (quote from the teacher’s notes). The barrier to taking part in the role-play was a little more difficult to overcome as many of the students felt shy acting out the roles. At the same time, both the students’ and the teacher’s reflections highlighted role-playing as one of the most productive activities, since it quickly identified and addressed many students’ errors and misunderstandings and placed discrete pieces of information in clear contexts.

While the creative tasks may have initially sounded daunting or uncomfortable, another risk was to focus too much on the aesthetic or artistic aspects of the activities. Unlike rote learning, creative teaching and learning activities are generative in the sense that not only meanings but also creative deliverables are constructed. It can feel rather unpleasant to be critiqued on one’s work—a poster or, especially, a video in which a student invested much time and effort. An aesthetically pleasing or technically well produced video may still contain factual errors or lack relevant depth. While the former aspects would not be assessed in the context of a medical programme, the latter would be critical. However, students often struggled to separate the two, at least emotionally. While this was not evident in the reflections, the teacher noted the sensitivity of the students when receiving feedback on their videos, which were like their “babies.” In other words, the quickly gained motivation provided by the novelty of the task could easily fade if students felt that their efforts were not good enough.

In the shadow of the exam (theme 4)

Despite the open, flexible nature of the creative and generative activities, students were anxious about the standardized Krok-2 exam that awaited them at the end of term. In the teacher’s experience, students are so focused on preparing for and passing the Krok-2 that they perceive the cycles in their final semester as an unnecessary distraction, so whatever the content of the cycle, it must be linked to the test. The disruptions to the educational process that had occurred throughout the students’ studies would inevitably create gaps in their coverage of the curriculum and ultimately jeopardize their ability to pass the Krok-2 test. The extent of these gaps would be assessed and addressed as the creative and generative activities were always followed by a review and discussion of the test questions. Students’ reflections evaluated this element as a positive.

Students also mentioned how working on the creative tasks helped them to memorize and understand the material covered in the Krok-2 tests. In particular, working on tasks that required collecting, selecting, organising, and communicating information, such as the association maps and the videos, seemed to be most helpful in this regard. In particular, the need to structure and organize information and select the key parts was recognized, as one student in group two wrote: “Drawing the poster helped to make an association of the disease with the drawings, helped to make a *brief* and *targeted* note about a particular disease” (emphasis added). Several students also linked learning the material to “going outside the comfort zone” that the activities enabled, which may also suggest that new conceptual links were made as a result.

Despite the efforts to closely connect the creative activities with the tests, some students—arguably more focused on passing the exam—indicated a preference for spending even more time reviewing the Krok-2 test questions. At the same time, many students emphasized the value of their learning more broadly—in their future professional practice and even in their personal lives when they have their own children, or their friends or family members have children. Some students mentioned how their skills could help them to learn in other contexts: “I will be able to use my acquired skills to study other disciplines in the form of illustrations with associations.” The fact that several students mentioned the importance of their knowledge and skills in non-

professional contexts could be related to the fact that they played non-professional roles in the role-play or produced the video for a wide, non-professional audience.

A learning community (theme 5)

Normally, the students in the groups would not know each other well before the start of the cycle. Given that this is the final year of their studies and that the cycles are rather short, this would rarely lead to the development of strong social links between the students. However, in their reflections, several students indicated that the emergence of a "close-knit" community was one of the most unexpected and memorable parts of the cycle for them. In particular, the production of the video and the creation of the map of associations, which required students to work outside of class, seemed to play an important role. As suggested in the previous themes, working with others encouraged and motivated the students to complete the given tasks, and also provided space for learning from and correcting each other. Moreover, it created a kind of learning community where some students worked together to complete other learning tasks outside the cycle. However, we did not observe this equally in all groups. It was mainly in group two and to some extent in group three that the written reflections referred to community building, whereas no such references appeared in the reflections of group one.

Nevertheless, students in all three groups highlighted collaboration and communication skills as key competencies acquired during the cycle. Although these were not the main objective of the tasks, collaboration and communication skills are seen as crucial for medical practice. The fact of working with other students—something quite unusual in the students' curriculum—helped to develop tacit knowledge and skills and possibly integrate them with the more factual and clinical knowledge. In this respect, the reflection process itself may have played a role, because when asked how responding to the reflection prompts had contributed to students' awareness of their own performance, several students in group three (the only group in which this question was asked) mentioned that it helped them to learn to express their thoughts and to communicate their opinions to others.

DISCUSSION

The use of creative and generative teaching and learning activities has a strong rationale for knowledge integration in the context of medical education, with its amount and fragmentation of covered knowledge and that of disruptions to the educational process, such as the war in Ukraine. In our inquiry, it is impossible to separate the two contexts, but arguably our findings have implications for both (see also Figure 2). Importantly, our inquiry examined knowledge integration at the level of teaching and learning activities that support students' ability to integrate, rather than as an element of medical curriculum reform, as is often the case in existing literature (Buja 2019; Loftus 2015; Vergel, Stentoft, and Montoya 2017). In fact, the application of creative and generative teaching and learning activities took place within the premise of a traditional medical curriculum that concludes with a standardized assessment of students' knowledge and skills.

As such, the use of the selected activities complemented, rather than replaced, more traditional didactic teaching methods. Combining the two had obvious advantages. First, knowledge integration conceptually presupposes the existence of some knowledge, which in medical education could mean factual knowledge typically acquired through rote learning (Buja 2019). The value of applying activities, such as association maps or role-playing, would be limited if students did not already have some relevant knowledge. Similarly, the presentations and video production activities required the consolidation of newly acquired and existing knowledge in the format of an inquiry-based learning task, described as applied research by Aditomo et al. (2013). Secondly, as the students' summative assessment remains in the form of standardized tests, it is in the students' interest to demonstrate their knowledge in the format prescribed by the exam.

Therefore, an important consideration is that the creative and generative activities are used in a way that makes them useful for passing the exam, for example, by reviewing sample test items after completing the creative activity. In this respect, these activities support the memorisation of information (Kopel, Brower, and Culberson 2021; Singh et al. 2019), but they also make learning more efficient by establishing new conceptual links between new and existing knowledge.

The perspective-taking aspect of integrating knowledge was particularly evident in our inquiry. Students pointed to the value of the association maps, role-playing, and video production in seeing some existing knowledge in a new light or in new contexts. Drawing on Green et al. (2016, 483), through these activities, students were able to "defamiliarize the familiar, cultivating awareness of new possibilities," as learning became less linear. The prominence of the perspective-taking aspect could arguably be explained through its departure from the traditional single-perspective presentation of medical knowledge, rooted in both its positivist origins and its fragmented delivery within different disciplines (Conrad and Barker 2010; Mann 2011). Our inquiry suggests that students are quick to adopt new ways of learning, if appropriately supported by the teacher.

At the same time, an unusual approach to teaching in the midst of a traditional curriculum has its drawbacks. Because an individual teacher has to invest more time and effort in preparing creative and generative activities than is expected in the institution's teaching framework, it discourages and limits the scope of such activities. Although the benefits for the educational process may be significant, the institution could be unwilling to change the teaching framework because it would require higher costs (Rodríguez et al. 2019). Furthermore, students may also be somewhat unprepared to participate.

While Green et al. (2016, 483) suggest that creative tasks allow students to experience "failure" in a safe setting, e.g., by "failing to create a perfect poem or to draw a flawless comic," we found that students are quite sensitive to their creative work being criticized and struggle to emotionally separate criticism of the professional content from their overall creation. Peer feedback can be incorporated to mitigate such effects, but it is important that students are properly trained to give feedback so that it does not exacerbate the problem, for example by focusing overwhelmingly on the aesthetic aspects of their peers' work (Lerchenfeldt, Mi, and Eng 2019). It may be beneficial to introduce creative and generative activities earlier in the curriculum so that students can get used to them. At the same time, this could also reduce the positive effects of the tasks' novelty on student motivation, which is particularly lacking in the final years of study and especially in a situation of prolonged stress caused by war or other shared external factors.

One of the main advantages of using creative and generative activities is their flexibility in meeting the needs of both academically well-performing and weaker-performing students. By taking a new perspective not only on knowledge but also on learning, some students may gain confidence as they feel more knowledgeable with newly established conceptual links. At the same time, students keen to advance their understanding can use the activities as a springboard for deeper exploration. While academically well-performing medical students are more likely to use deep learning strategies and have deep motives for learning (Urrizola et al. 2023), these motives are largely shaped by factors outside the classroom and are therefore often pre-determined prior to the learning process. What well-scaffolded creative teaching and learning activities can offer is a tool to experiment with a different way of engaging with learning material, both for students with surface motives or strategies and for those with deep motives and strategies. Crucially, it allows students to bring their personal interests into the learning process in a way they cannot with rote learning alone.

In other words, creative and generative activities are interesting and motivating to students not only because of their novelty, but also because they allow students to use them in ways that are personally meaningful. Our inquiry found that, overall, students perceived the applied activities enjoyable and exciting, which is consistent with the limited research on the use

of creative approaches in medical education (Green et al. 2016; Rodríguez et al. 2019; Singh et al. 2019). Making teaching and learning enjoyable is important in medical education, which is commonly characterized by high levels of stress, burnout, and, as a possible consequence, attrition (Kopel, Brower, and Culberson 2021; O'Neill et al. 2011). However, the importance of this dimension is even more pronounced in times of disruption. When disruptions are caused by pervasive external factors, such as the Covid-19 pandemic or the war in Ukraine, it is plausible that students' (and, to a large extent, teachers') motivations are influenced less by the learning environment and more by those external factors (Tomej 2022). However, our inquiry suggested that the learning communities formed as a result of completing the creative tasks play an important role in sustaining students' motivation. This finding again supports the importance of regular, meaningful social connections between students during periods of disruption (Hall et al. 2020). It also implies that creative and generative tasks shape knowledge integration not only directly, but also by improving students' motivation and encouraging the creation of learning communities where students support each other's learning.

CONCLUSIONS

This article describes a SoTL inquiry into the use of creative and generative teaching and learning activities to support medical students' knowledge integration in the context of prolonged disruption to the educational process due to the war in Ukraine. The activities included preparing presentations in pairs, drawing and presenting association maps, role-playing a clinical situation, and producing a video on a given topic for a wide audience. All activities were carried out by the students collaboratively in groups, with feedback and feedforward from the teacher. The research was based on students' anonymous responses to reflection prompts prepared by the teacher (first author) and the second author, as well as the teacher's notes.

The war context and the disruption it caused did not feature prominently in the students' reflections, perhaps reflecting how embedded this context is in the lives of Ukrainian students. However, our research indicated the crucial role of the creative and generative activities in encouraging students to create learning communities which helped to maintain motivation and perseverance through the stressful experience of studying medicine in very difficult circumstances. At the same time, the activities also had a more direct impact on students' knowledge integration – helping them to develop new conceptual links by identifying new associations, new perspectives, and new contexts for existing knowledge. They also improved students' confidence in a number of ways. In particular, the activities helped to relieve some stress, reveal and demonstrate the students' learning processes to each other, and provide an opportunity for the teacher to support learning with continuous feedback. In addition, the activities allowed students to experiment based on their own strengths and interests and were therefore useful for both academically strong and weaker students.

The inquiry also highlighted some of the challenges of using creative and generative activities in medical education where they are not otherwise widely used. Students may find the activities confusing or unfamiliar and may also be more sensitive to criticism of the creative artefacts they produce. It is also important that the creative tasks are well linked to other elements of the curriculum so that students can see how taking part in these activities helps them to complete their education. All these and other considerations require time and effort on the part of the teacher, which may not be in line with the institution's teaching framework.

This SoTL inquiry is the product of its specific context. Its small scale has its limitations, as does the format for capturing students' knowledge integration. It is likely that providing students with the reflection prompts had an impact on students' perceptions of the activities and their learning. However, rather than seeing this as an observer bias, we recognize the crucial role of reflection as a teaching and learning tool in itself. Therefore, we also asked students in one group to contemplate the role of reflection. Our findings can be useful to medical education programmes

that face similar common challenges to those in our context. They also provide a better insight into how creative and generative activities can be used as a means of supporting students in times of crisis and disruption in the educational process.

NOTES

1. The word "generative" is meant in the sense of generating and constructing meanings.

AUTHOR BIOGRAPHIES

Adrian Tomey (UKR) is associate professor in the department of childhood diseases, faculty of medicine, at Uzhhorod National University in Uzhhorod, Ukraine, where he teaches paediatrics to senior medical students. He is also deputy editor-in-chief of the Ukrainian journal Problems in Clinical Paediatrics*.*

Kristof Tomej (DNK) is associate professor in the department of design, media and educational sciences, at the University of Southern Denmark in Kolding, Denmark, where he teaches courses in sustainable tourism management and tourism co-design.

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APPENDIX

The English translation of the reflection prompts used in the inquiry

- Which task/activity during this cycle surprised you the most, interested you the most, or was the most memorable for you? Why?
- What do you see as the result of today's/this week's session(s) for you personally? Did you gain new knowledge or skills? If so, which ones?
- What elements of the assignments, materials, and/or interactions with the teacher or other students helped you the most to acquire new knowledge or skills?
- How and in what context will you be able to apply the new knowledge or skills in the future? (e.g., within this or other academic disciplines, professional practice, in life situations, etc.).
- (Only provided to group 3 for their final reflections) How do you think that answering these and the previous reflection questions has contributed to your own awareness of your own work?