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PRACTICAL TIPS

The online inverted classroom model (oICM). A blueprint to adapt the inverted classroom to an online learning setting in medical and health education [version 2]

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Abstract

This article was migrated. The article was marked as recommended.

The idea of this paper is to offer a blueprint, to guide educators setting up a complete digital teaching scenario according to the latest insights of educational research.

The COVID-19 pandemic forced higher education institutions all around the world to radically shift their curricula from a mix of face-to-face and remote teaching methods to a fully remote curriculum. Though challenging, this time provides opportunities to implement new educational methods and to improve the quality of digital teaching. The concept of the inverted classroom was modified to meet

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version 1 28 May 2020	view	view	view	view	

1. **P Ravi Shankar**, American International

the special needs of the new online settings. The proposed online Inverted Classroom Model (oICM) includes the following phases: (1) pre-phase, (2) self-learning-phase, (3) synchronous online phase, (4) transfer-phase, and (5) evaluation. Recommendations and potential tools are provided for each phase. The oICM is an innovative and easy to use approach to shape digital teaching and learning processes during and after the COVID-19 pandemic. This blueprint is developed by the committee "Digitalization" of the German Association for Medical Education (GMA), mainly for educators who are familiar with the Inverted Classroom Model (ICM) or similar blended learning formats.

Keywords

inverted classroom, flipped classroom, oICM, medical education, health education, digital teaching, synchronous online teaching

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Any reports and responses or comments on the article can be found at the end of the article.

1. Introduction

During the CoVid19 pandemic, educational institutions had to quickly adapt their curricula to digital teaching. Despite the lack of resources, such as time and experts for digital teaching, the shift in education moved from traditional lectures and seminars to online learning environments. Hence, we face a state that can be best described by "Emergency Remote Teaching" (Hodges *et al.*, 2020). This is a challenging time, but it also holds opportunities to improve the quality of digital teaching and learning if implemented appropriately. We would like to offer an approach to face the challenge of digital teaching and to implement a new way of online teaching using an existing concept and modifying it to the special needs of this time plus the time after the pandemic. Thus, we propose a blueprint for the application of the inverted classroom model (ICM) in an online setting to minimize the disadvantages of online teaching and to achieve real benefits with digital teaching methods.

2. The traditional Inverted Classroom Model

According to several meta-analyses, the inverted or flipped classroom method (ICM) showed positive effects regarding engagement, motivation, overall satisfaction, and learning outcomes (Chen, Lui and Martinelli, 2017; Lo, Hew and Chen, 2017; Cheng, Ritzhaupt and Antonenko, 2019; Låg and Sæle, 2019; van Alten *et al.*, 2019; Strelan, Osborn and Palmer, 2020). ICM has successfully been implemented in healthcare education (McLaughlin *et al.*, 2014; O'Flaherty and Phillips, 2015; Tolks *et al.*, 2016; Chen, Lui and Martinelli, 2017; Hew and Lo, 2018). The idea behind the concept of the inverted classroom is to use the face-to-face time for the more challenging part of knowledge application, instead of presenting the conceptual knowledge in a lecture in which students have to take a passive role (Lage, Platt and Treglia, 2000). The overall goal is to focus the face-to-face phase on the interactions between students and teacher and to solve problems that may arise during the knowledge application. According to Bloom's taxonomy, the ICM creates a learning environment that enables the learner to reach a higher level of cognition (Anderson *et al.*, 2013). One of the basic ideas behind the concept is to engage the learner based on the concept of active learning (Snyder, 2003).

3. The online Inverted Classroom Model (oICM)

Faced with the challenges of the corona pandemic, universities had to adapt their curricula to online methods quickly. The traditional ICM proposed by Tolks *et al.* was adapted purposefully for the new online approach (see Figure 1) (Tolks *et al.*, 2016).

This blueprint was mainly designed for educators without prior experience with the ICM, who already use blended learning or especially the traditional ICM. However, teachers with no prior experiences can also use this blueprint but probably will require more preparation and maybe guidance.

Online teaching can be differentiated in synchronous vs. asynchronous delivery modes. In synchronous teaching learners and teachers meet at the same time with video conferencing tools. In asynchronous teaching, learning media is produced and, for example, provided via a learning management system (LMS), where learners consume content *ad libitum*. The advantages and disadvantages of both modes are listed in Table 1.

As mentioned before, the most important part of the oICM is to maintain learner activation. Active rather than passive learning requires the involvement of students in the learning process, resulting in a more intense learning experience that goes beyond memorization (Snyder, 2003). Active learning leads to more sustainable knowledge acquisition and promotes problem-solving skills (Chi and Wylie, 2014). Furthermore, activities and interaction create a more learner-centered environment and are based on constructivist teaching rather than a direct instructional, mainly unilateral approach (Salmon, 2013). Designing clear learning outcomes for online learning is just as important as for face-to-face environments.

3.1. Pre-phase

Before starting to teach, the learners have to be informed about the concept and process of the oICM, technical requirements, learning outcomes and expectations. It is important to offer the possibility to co-shape (e.g. a short pre-survey) and to use communication channels for your learners. This can be done via your LMS or by e-mail or a short synchronous session. At this stage students should be able to explain why they want to participate. What makes the course interesting? Therefore, special attention should be paid to the learning experience from the beginning (*e.g.* intuitive learning tools, clear structure of the learning process).

3.2. Online Self-learning phase

As for ICM, in this asynchronous phase, it is important to provide learning material that targets the needs of your students. Students are used to learn from videos so we recommend using videos as a source for online learning (Hurtubise *et al.*, 2013) as well as interactive tools. There are a fast variety of different methods and tools available. For some
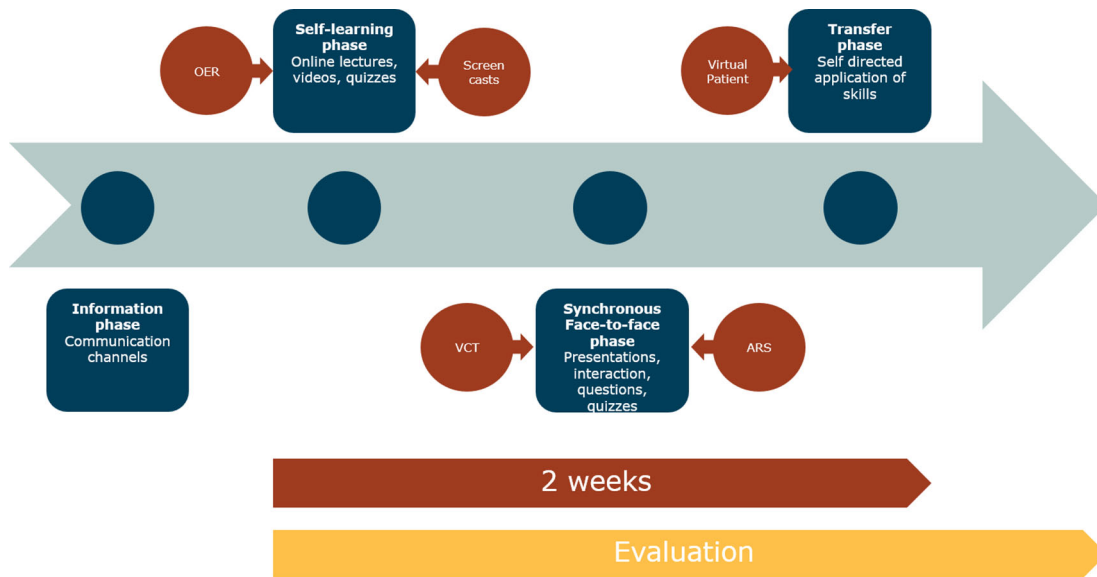
Figure 1. The online inverted classroom model (oICM)

Table 1. Advantages and disadvantages of synchronous and asynchronous delivery modes

	Advantages	Disadvantages
Synchronous	Instant interaction for communication and collaboration Less isolation Corporate feeling Fast reactions to uncover misunderstandings	Rigid time window Fast internet connection needed Sophisticated hardware and software needed Quiet and acoustically as well as brightness adequate environment needed
Asynchronous	content can be downloaded everywhere any time - i.e. flexibility for time and place Students could spend more time on task - e.g. review material Permanent availability	Very limited communication and collaboration Missing social interaction Misunderstandings undetectedHuge amount of data Copyright and privacy violations if content is stored publicly available

recommendations, you can look at the list of the digital tools (German) from the committee "Digitalization" of the German Association for Medical Education (GMA): tinyurl.com/ADTLLGMA

There are many ways to create learning content using videos. We would endorse three different approaches.

The easiest way to create great videos is by using screencasts. Screencast software (*e.g.* Screen-O-Matic, SnagIt) allows you to record your presentation together with your speech. You may also include a video of you while talking. These programs are mostly free of charge and easy to use. Be aware that the presentation does not have to be perfect from a technological and rhetorical point of view. A study by Carpenter *et al.* (2013) has shown, that, with imperfect presentations, learners have a higher cognitive activity and a better knowledge retention rate compared to perfect presentations. Care should be taken to ensure that presentations are not overloaded with content and complex animations, but are structured, in high-resolution and reduced to essential elements. This applies especially to online teaching. To support the learning process, a handout could be useful. You can also use existing video tools that help you create innovative learning videos with cartoons (PowToon) or draw images with a digital pencil.

Another possibility is to record the speaker with a camera. This is often used in massive open online courses (MOOCs). These learning videos were analyzed in a study by Guo, Kim and Rubin (2014) regarding the engagement rate of students. To improve learner engagement, the following recommendations can help to improve the quality of the videos:

- Shorter videos are much more engaging

- Videos that intersperse an instructor's talking head with slides are more engaging than slides alone

- Video produced with a more personal feel could be more engaging than high-fidelity studio screencasts

- Khan-style tablet drawings tutorials are more engaging than Powerpoint slides

- Videos, in which instructors speak fast and with enthusiasm, are more engaging

- Students engage differently with lecture and tutorial videos

A third approach is based on Open Educational Resources (OER). You can always use freely available learning content that is offered under an open-access license. Many universities offer their high-quality learning material including universities like Oxford, Harvard, Cambridge, or the Massachusetts Institute of Technology. Or you look at special databases *e.g.* Open Education EU to find suitable learning material.

During the online self-learning phase, quizzes engage the learners during and after the learning sessions and offer a way to assess their learning process. At the end of the self-learning phase, a final quiz should be implemented to assess the learning status of the group. If any problems or low rates in quiz occur, the teacher can address them in the upcoming online face-to-face phase. Most LMS provide tools for assessment and self-assessment.

3.3. Synchronous, online face-to-face phase

In an ICM setting the self-learning phase is followed by a face-to-face phase. One way to reduce the limitations of an online scenario such as low retention and engagement rates of students is to use synchronous online meetings. In oICM, this phase will take place online using video conferencing tools (VCTs), such as AdobeConnect, Zoom, or GoToMeeting. As in ICM, the session is moderated by the educator in real-time and in an interactive way. Depending on the number of students, this can be realized in form of interactive webinars or small group discussions making use of the small group rooms most VCTs offer.

In addition to VCTs and in order to engage the learner you can use various, easy-to-use, digital tools. Helpful tools are audience response systems (ARS) such as Kahoot!, Mentimeter, and/or Pingo or VCT integrated tools. Applying those programs, the facilitator can quiz students, create word clouds, rate questions, and use gamification approaches such as points, leaderboards, and badges (Sailer and Homner, 2019). The (o)ICM offers a good structure to implement gamification aspects within the learning scenario (Sailer and Sailer, 2020). Addressing questions with the help of ARS continuously activates participants to collaborate on the content and thus allow a more thorough reflection. While in traditional teaching sessions potentially more than half of all present participants are mentally distracted, ARS effectively counteracts this. Overall, they have a proven positive effect on learning outcomes (Nelson *et al.*, 2012; Szpunar, Moulton and Schacter, 2013). In addition, the facilitator receives feedback from a large proportion of those present. A further benefit for the use of ARS in the oICM: Once an interactive quiz is used, learners are more likely to use the chat or audio connection for discussion.

This way, the moderator gets feedback, and it lowers the barrier for students to participate actively by talking or using the chat function. Case-based learning and problem-oriented learning can be easily facilitated by combining an online-meeting with collaborative online documents. For creating complex classifications, students might be asked to build a concept map (*e.g.* Miro, MindMap or integrated whiteboard in ZOOM).

For students not attending the online synchronous meeting, the session can be recorded and uploaded to the LMS. In this case, every participant must agree to the recording and its use. However, we recommend including some additional homework to avoid a drop-out of the regular online sessions.

3.4. Transfer phase

The transfer phase deepens the learning outcome with another asynchronous learning session, where the learner will be challenged to apply their knowledge and transfer it to other content domains or contexts. This can be achieved with small projects students have to work on collaboratively, *e.g.* solving problems, virtual patients, virtual labs or let students develop cases or videos themselves.

4. Evaluation

After the oICM, it is also important to evaluate the process and outcome of the curriculum. Especially the online face-to-face phase should be critically assessed in the evaluation as it is a new approach within the ICM concept. We recommend integrating the evaluation into the online face-to-face meeting to enhance the response rate.

There already exist validated tested evaluation questionnaires for traditional teaching sessions like lectures and seminars (Perry and Smart, 2007; Schiekirka *et al.*, 2015). However, it is possible to develop a short evaluation questionnaire for oICM based on existing instruments of traditional teaching and online teaching. In Appendix 1, we provide some examples for items structured by different aspects of teaching.

5. Conclusion

The oICM is based on the traditional ICM. The focus is on synchronous digital teaching, the activation of learners, and making use of VCTs and ARS. The oICM concept supports educators in transferring their previous face-to-face teaching into online teaching in a structured and meaningful way.

An advantage of the oICM concept is that after returning to face-to-face teaching nearly all the phases can be used without changes. The synchronous phase can be easily transformed into face-to-face teaching such as small group sessions or seminars including transferring the concept and content for using ARS.

Thus, with a few modifications of the existing ICM concept and with this easy-to-use approach presented here, it is possible to significantly improve digital teaching and support students in their learning process. Another positive aspect is that the oICM can be used even after the pandemic as ICM. The online learning material provided can be used during the self-learning phase for the teaching concept. The online ARS can be used during the face-to-face phase to activate the learners. Before, during and after the CoVid19 pandemic, oICM is an innovative approach to shape digital teaching and learning processes.

We hope that with this blueprint educators will be able to develop their own oICM teaching concepts, that also can be used after the pandemic and additionally build concepts that are feasible for the future. We would like to encourage all educators to invest more time in their teaching concept now and use this blueprint so that these challenging times have a positive impact on teaching.

Take Home Messages

- The online Inverted Classroom Model (oICM) is an innovative and easy to use approach to shape digital teaching and learning processes during and after the CoVid19 pandemic. With a few modifications of an existing ICM concept educators can transform their face-to-face teaching activities into digital teaching.

- The proposed online Inverted Classroom Model (oICM) includes the following phases: (1) pre-phase, (2) online self-learning-phase, (3) synchronous online face-to-face phase, (4) transfer-phase, (5) evaluation.

- The most important part of this concept is to maintain learner activation with synchronous digital teaching using video conferencing tools (VCRs) and audience response systems (ARS).

Notes On Contributors

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Appendices

Appendix 1: Evaluation questionnaire

Aspect of teaching	Items	Scale/ Answer format
Organization and technology	It was clearly communicated from the beginning how the online course format will look like.	5 Point Likert Scale for agreement n.a.
	Technical problems occurred before or during the teaching session.	5 Point Likert Scale for agreement n.a.
	If yes, please briefly describe the technical problems:	Free text question
Learning content	Which online activities (forms of learning/learning materials) were used in the teaching session?	Online communication (e.g. Forum) Live lesson (e.g. via Zoom or Adobe Connect) Selflearning test (e.g. MC questions, AMBOSS question sessions) Instructional video Podcast (audio record) Script (e.g. PPTslide sets, summaries) Online (group) task

Appendix 1: *Continued*

Aspect of teaching	Items	Scale/ Answer format
	I have participated in live lessons or online communication (*e.g.* forum).	Completely Partially Not at all n.a.
	I have used/worked with the provided online learning materials.	Completely Partially Not at all n.a.
	The learning content of the provided materials was understandable.	5 Point Likert Scale for agreement n.a.
	Which online activities were particularly helpful for you and why?	Free text question
Didactics and support	The learning goals that I was supposed to achieve were clarified at the beginning.	5 Point Likert Scale for agreement n.a.
	The online activities in this teaching session had clear tasks and goals.	5 Point Likert Scale for agreement n.a.
	During online activities the teacher supported me well.	5 Point Likert Scale for agreement n.a.
	The lecturer responded well to questions and suggestions.	5 Point Likert Scale for agreement n.a.
	I was encouraged to critically reflect upon the contents taught.	5 Point Likert Scale for agreement n.a.
Learning success	I can give an overview of the contents of the teaching session.	5 Point Likert Scale for agreement n.a.
	Measured by my previous knowledge, I learned a lot during the teaching session.	5 Point Likert Scale for agreement n.a.
Overall rating	I particularly liked the following aspects of the teaching session:	Free text question
	The following three aspects should be improved:	Free text question
	Overall, I rate the attended teaching session with:	5 Point Scale: excellent to insufficient n.a.

Declarations
The author has declared that there are no conflicts of interest.

Ethics Statement
This is a didactical blueprint to develop and teach digital. No data, patients or students have been involved in the process.

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Open Peer Review

Migrated Content

Version 2

Reviewer Report 05 October 2021

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Stijntje Dijk
Erasmus Medical Center

This review has been migrated. The reviewer awarded 4 stars out of 5

The authors provided a helpful blueprint to medical teachers seeking to use a flipped-classroom approach in an online environment setting. In this helpful paper, they lay out steps to consider, from rationale, preparation of asynchronous learning materials, the synchronous session, a short note on transfer of knowledge, and the evaluation. The paper provides those with an interest in the topic with a collection of tips and tricks mostly regarding the preparation of learning materials. Additionally, the authors are to be congratulated on the diverse group of contributors to this paper.I have some notes in reaction to the paper, none of which require a full revision of the paper by themselves, but could be taken into account for future work / planned revisions:- The paper does not contain a section / explanation / reflection on how the blueprint came to be. Although it is a review of literature much more than empirical research, the paper may benefit from a section added to the introduction or elsewhere describing the methodology of writing the paper would be helpful.- The paper focusses mostly on the presentation of information (short/long videos, powerpoint vs alternatives, the use of quizzes). When thinking about the creation of learning content, a crucial part of the design of educational material is also the actual content: What type of learning objectives/topics could be more / less suited for this format? Crucially, next to what formats/platforms/tools to use, how can the facilitator assess that students prepared for the session and correctly understood the material? What happens in the transfer phase, how can a facilitator guide students to ensure that knowledge is further deepened and not lost? I would consider two approaches to these rising questions: to either specify that the blueprint specifically aims to guide choices in preparation of learning material rather than all aspects of flipped learning, or to dedicate additional attention to the assessment of learning.- A short note on terminology: I had difficulty finding out what "Khan-style tablet drawings" were, I assume this is a reference to the platform Khan Academy? Additionally, Powtoon is spelled as Powton.I would like to thank the authors for providing this blueprint, which can be very helpful to those seeking tools and tips to make their online teaching more engaging.

Competing Interests: No conflicts of interest were disclosed.

Reviewer Report 05 October 2021

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Ken Masters
Sultan Qaboos University

This review has been migrated. The reviewer awarded 4 stars out of 5

The authors have addressed my main concerns about Version 1 of the paper, and have clarified several concepts, and have also ensured that novices would not have unrealistic expectations of the task.Although the implementation would require adaptation to specific circumstances, the paper serves as a useful guide for moving the inverted classroom to the online environment.

Competing Interests: No conflicts of interest were disclosed.

Version 1

Reviewer Report 16 October 2020

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Ken Masters
Sultan Qaboos University

This review has been migrated. The reviewer awarded 3 stars out of 5

An interesting paper on how to adapt the inverted classroom to an online learning setting in medical and health education. This is a useful contribution for teachers struggling to cope with the new demands of online teaching. The Appendix is also a useful sheet, especially for novices or for those who do not wish to work through the (sometimes) very demanding industry-standards. There, however, a few issues that

need to be addressed.• The paper says that "This blueprint is designed for teachers without any prior experience with the ICM, but also for those who already teach in a traditional ICM". I think, however, if someone has never used ICM before, then there would have to be far more training than this blueprint, and I think the authors are a little blasé about just how difficult it is for people to transition from old-style didactic teaching to any ICM process (if it were easy, everybody would be doing it). So, I think that the authors should make it clear that this would serve those who already use ICM in face-to-face teaching; those who don't would do well to team up with a person experienced with ICM, or, if they have access to decent educational support structures, then consult and be guided by those. • The "Pre-phase" and "Transfer phase" could do with some expansion and examples, especially as this paper would be mostly beneficial to novices.Smaller issues• I am presuming that the heading "3.1 Pre-phase" corresponds to the portion "Online information Phase" in Figure 1. If so, this should be made clearer (either use the same words, or refer directly to it); if not, then it should be explained.• Although the abbreviations in Figure 1 are explained later in the text, they should also be given as a key to Figure 1. This is in keeping with the standard process of expanding an abbreviation the first time it is used anywhere in the paper. I look forward to Version 2 of this paper in which these issues are addressed.

Competing Interests: No conflicts of interest were disclosed.

Reviewer Report 11 June 2020

https://doi.org/10.21956/mep.19005.r27265

Hebat Allah A. Amin
Department of Pathology, Helwan University, Faculty of Medicine

This review has been migrated. The reviewer awarded 4 stars out of 5

Thank you for your informative, well-structured guide. I've benefited from reading this interesting experience. The evaluation table added value to the work. Much appreciated.

Competing Interests: No conflicts of interest were disclosed.

Reviewer Report 11 June 2020

https://doi.org/10.21956/mep.19005.r27263

Nagwa Hegazy
Menoufia university

This review has been migrated. The reviewer awarded 4 stars out of 5

Informative great work. great descriptive guide with a good evaluation checklist.thanks

Competing Interests: No conflicts of interest were disclosed.

Reviewer Report 28 May 2020

https://doi.org/10.21956/mep.19005.r27266

P Ravi Shankar
American International Medical University

This review has been migrated. The reviewer awarded 4 stars out of 5

This is an interesting manuscript describing how an inverted classroom model can be adapted for an online approach during the pandemic. The paper has been written very well and is easy to follow The questionnaire used to evaluate the model shown in the Appendix is also easy to use. I am not sure what an AMBOSS question mentioned in Appendix 1 is. I enjoyed reading this well-written manuscript. The article will be of interest to all educators.

Competing Interests: No conflicts of interest were disclosed.