

# Implementation of Critical Threshold Concept in Clinical Transplantation: A New Horizon in Distance Learning

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## **Abstract**

**Background:** *While variations in medical practice are a norm and each patient poses a multitude of challenges, many clinicians are not comfortable in dealing with unexpected complex issues even though they may have enough knowledge as demonstrated by passing a number of tricky certifying (or exit) examinations. One reason for the lack of self-efficacy, even if being endowed with good knowledge, is that we are not good in learning from errors. A regular reflective practice offers superb learning opportunities when a clinician is “stuck in a mire”. Difficult clinical situations warrant a flexible and, at the same time, an evidence-based approach to ensure that crucial decision-making process is correct and efficient. Each clinical case offers a great opportunity to reinforce these “threshold concepts”, however, not everyone of us is “blessed” with these crucial not-so-difficult-to-acquire skills so necessary to be a life-long learner.*

*The faculty of this course (a totally on-line MSc in Transplant Sciences) aims for unceasing engagement with students in order to facilitate them to negotiate through “stuck places” and “tricky bends” in their own work place. This course, not just meant for knowledge transfer, provides a platform that allows participants (the students and faculty) to learn from each other’s experience by using “e-blackboard”. The mainstay of this course are twofold: (a) Emphasis on achieving critical decision-making skills, (b) Regular feedback to allow reflective practice and, thereby, constantly learning from errors and reinforcing good practices. The aim of this article is to assess the performance of educators and how well the “ethos of critical threshold” has been accepted from the perspective of students.*

**Methods:** *The critical thresholds of each chapter in 4 modules of this totally on-line course were defined to a razor-sharp precision. Learning objectives of learning activity were defined to achieve*

*constructive alignment with critical threshold. We employed level 1, 2, 4 and 5 of Kirkpatrick pyramid, (a) for the evaluation of performance of educators of program, and (b) to evaluate the acceptance of this non-traditional format in clinical medicine education by postgraduate 80 students in 22 countries.*

**Results:** *Students' survey (Kirkpatrick level 1) was done only for module 1 of cohort 1 reported students' satisfaction rate of 93%. Excluding a total of 12 drop-outs in 2 modules (n=10 in first cohort's module 1, and n=2 in module 2), as many as 93% of students of first cohort passed module. Nine out of 60 registrants of module 1 in 2nd cohort took recess for one year requesting to join back as a part of 3rd cohort commencing one year later, all 51 who continued passed though 3 of them had to resit. All those who passed module 1 (both cohorts) and 2 (1st cohort) registered for their respective next module (return on investment Kirkpatrick level 5).*

**Conclusion:** *For a successful model in distance learning in clinical transplantation it is imperative for the students to accomplish well defined "critical-decision making" skills. In order to learn critical thresholds, a regular feedback is integral to learning from reflective practice. This course equips the students to develop skills of negotiating "sticky mire", as obvious from perceived high return of investment.*

**Keywords**

*threshold concept, gateway concept, distance learning, transplantation, and clinical education*

## 1. Introduction

The National Health Service (NHS) in the UK expects all the health professionals to go through the process of revalidation in a standard time frame and thereby ensuring that the patients are managed by those who keep up-to-date with evidence based medicine that many by rather tricky in the current situation that is blighted with ever-growing, rather explosion of, medical knowledge. Given the very busy professional life, with inherent difficulties in having to take time off work and to be away from domestic commitments, it is prohibitively difficult for most health professionals to attend taught courses that require them to be away from work place and home. The health professionals from developing countries do face similar problem but of much bigger magnitude, where the health care system suffers from resource crunch and is blighted by the lack of regulation.

Distance education has been in vogue for longer than century, the medium of delivery has changed from pencil and paper correspondence courses to real-time internet-based courses. For participation in the process of "open learning" the students need supervision, encouragement, corrections, guidance and support almost on a 24/7 basis in order to have an access and facilitate interaction with online materials. In online courses the faculty guides the students to develop skills, competence and confidence that are immensely crucial to navigate though troubled waters. This processes of letting the students learn by reflective practice, the faculty should be designing the online teaching by performing e-moderation using e-blackboard. Distance learning obviates the financial cost of travel and accommodation, and enables the course participants to learn from their own local clinical experience (keeping the context

alive) while fulfilling their work commitments and on-call responsibilities. Reflective practice is a simple immensely effective learning instrument available to all of us all the time, otherwise not so well used by many clinicians, that enables life-long learning by making best use of (good and not-so-good) work place experiences. Learning while working brings in the context and relevance to the process gaining expertise, and thereby self-efficacy, so integral to the principles of adult learning.

In this article, we illustrate our experience of designing and conducting a totally online course in clinical transplantation. This course is designed to deliver up-to-date knowledge and state-of-art clinical experience in transplantation reflecting the clinical practice of many UK as well as well-known international centres. Successful completion would lead to award a degree from the University of Liverpool, a Russell group of universities that ensures credibility and quality assurance of the education.

It is the first of its kind in tackling unfilled lacunae in a rapidly expanding and continuously ever-evolving subspecialty. In many overseas countries, there is no structured clinical training program in transplantation, where the trainees “learn on the job”. Even within the UK, the training is not consistently uniform. Some units are surgeon-led. The renal physicians have rather limited role in surgeon-led units where they could contribute much more for the best care of patients since it is the physicians who are formally certified and are experienced in dealing with medical problems. On the other hand there are units that are physician-led where the surgeons’ contribution is limited to dealing with the surgical aspect of transplantation that has a risk of limiting them to “surgical technicians”. Ideally, the physicians and the surgeons should be sharing responsibilities in a mutually supportive environment complementing each other. We believe that providing state of the art clinical teaching in transplantation will help clinicians, who get academically marginalized, to have more active role in the patient’s care.

A list of key steps is worth highlighting in establishing a totally on-line degree course. It is crucial to define threshold concepts that the students should be able to understand. It is very essential for the students to be endowed by (either inherent or acquired) threshold attitudes that are so necessary to allow reflective practice, and to acquire critical threshold of self-efficacy so necessary to be able to navigate on-line system and e-blackboard. The faculty, though need not to be a technophile and highly proficient in technology, they must develop critical threshold skills that are needed to for them to develop as online educators. It is imperative for the participating faculty to appreciate critical thresholds that would require them to participate in professional development programs that will enable them to be an effective educator in an on-line course. Threshold concepts have been paraphrased as “gateway concepts” as well because once these are appreciated and “digested”, the students can build and evolve solutions of much more complex problems around these concepts that are referred as “fund as” in some lingo! It just means that those who have good “fund as” are adept at fundamentals that are very essential in laying foundations of critical-decision making.

The coursework includes a range of activities include developing skills of poster presentation of their

own reportable clinical cases. As a part of assessment, the students are asked to formulate a treatment plan supported by current scientific evidence. In addition, the students are given weekly task of responding to published articles by performing critical appraisal. This is another critical threshold for faculty to be able to do teach this key skill and for the students to develop a very desirable skill in their professional career. Needless to mention that the students require guidance and support (almost on a 24/7 basis) to access e-blackboard that lets them interact with fellow students and faculty through e-blackboard.

We implemented dynamic curriculum pedagogy to engage a diverse cohort of students. Some students preferred interactive clinical scenarios as their main learning strategy to address our learning objectives. Other students preferred our on-line journal club. The articles for journal club were carefully selected to deliver a clear message based on systematic review or meta-analysis. Review articles were employed when articles reporting meta-analysis or randomized controlled trials case series were not available to address an issue in consonance with learning objectives. We provided multiple choice questions and the students matched their answers against standard answers supplemented by detailed explanation that were based on current guidelines and evidence. These complementary strategies engaged the students to help them address the dimensions that were not covered by the lectures.

Most faculty members did not have experience in on-line teaching. As their experience grew, their perceptions of their self-efficacy improved. This increasing confidence of course faculty was a result of handling technology as they gain experience in conducting and moderating on-line course as reported by Robertson and Abdulrahman.

The first author of this article was very skeptical when in 2014, the second author and the director of totally online MSc in Transplant Sciences, asked him to join as co-lead when that course was in a formative stage. Not just being a technophobe the major reason for being so doubtful was: when there is no face-to-face meeting with students then how is it possible to achieve an effective interaction so crucial in providing feedback that is necessary for reflective learning. Within 6 weeks of starting the course he (the first author) converted as he realized that being in different time-zones is not a hurdle, face-to-face meeting is not a limitation and giving feedback in response to discussions on e-blackboard is an immensely worthwhile experience for the students and faculty. Shepherd et al. reported similar observation because inherent technophobia and a self-perceived lack of knowledge can lead to anxiety about online teaching.

When defining crucial thresholds the faculty has been very clear that it is not going to be just another passive knowledge transfer course. The faculty strongly believes that there is no dearth of resources where from knowledge and information can be acquired and, therefore, there is no need for one more course to be added to that long list such courses that do not focus on developing the skills of reflective practice that are so necessary in making use of experiences of professional life. Reflective practice facilitates learning from their own clinical experience by taking clinicians to enter Kolb's cycle. Crucial thresholds that students are expected to cross, whereby, the objectives of each chapter or a topic are

defined so that the performance of students can be measured in order to achieve constructive alignment. Crucial thresholds and the learning objectives were defined by the faculty of this course for each chapter of 4 modules. A large number of clinicians may not have a consistently available and dependable opportunity for a scientific discussion. This lets the student develop skills of “self-help” that are essential in evolving expertise by multitude of links to their own current and past experiences (adult learning). The aim of this article is to assess the performance of educators and how well the “ethos of critical threshold” has been accepted from the perspective of students.

## 2. Methods

The critical thresholds of each chapter in 4 modules of this totally on-line course in MSc in Transplant Sciences were defined to a razor-sharp precision. Learning objectives of learning activity were defined to achieve constructive alignment with critical threshold. We employed Kirkpatrick pyramid, (a) for the evaluation of performance of educators of program, and (b) to evaluate the acceptance of this non-traditional format in clinical medicine education by 80 postgraduate students in 22 countries, majority of them being busy transplant clinicians.

In regards to the assessment of students in this course, the crucial threshold was how well the assessment aligns with learning objectives. In other words, the validity of the assessment process is that it should be testing how logical the approach of a transplant clinician is in accomplishing safe, efficacious and cost-effective care. “Does this course change their behavior of transplant clinicians” is the critical threshold we would like to see. However, this change in behaviour is not so easy to measure quantitatively. This course is delivered wholly online implementing an asynchronous approach to overcome the time zone differences as it targets both home and international students. We addressed critical threshold issues in our MSc Transplant Sciences. In regards to critical threshold concepts, the faculty had defined the objectives of each of 400 clinical cases that have been used in 4 modules. We continued to modify, refine and evolve our approach as we faced a number of newer and unexpected issues during the progress of course so that critical threshold objectives be achieved. The following are the steps to achieve critical threshold for technology:

- 1) Not all the students were able to login in the beginning on day one. The underlying reasons ranged from lack familiarity, slow speed, lack of permission to external sites (at their workplace) while doing the MSc work at workplace, and lack of technical support outside working hours.
- 2) The faculty provided a robust support so that the students could develop skills of creating e-resources and e-activities.
- 3) Manual has been defined to ensure that the students are well versed with setting up tasks, submission of assessments, the marking of assessments, and the mechanism of providing regular and effective feedback.
- 4) How to help the student’s link to their own experience (adult learning).
- 5) Students were encouraged to contribute regularly to discussions on e-blackboard in order to gain

maximum out of online course by learning from each other's experience (develop links with what they already know).

We maintain contact with the students using several different tools; Facebook®, Skype®, mobile phones and other social media, in addition to the assigned university Blackboard®. Any student who was not contributing for 2 weeks was contacted. On many occasions, they were facing technical problems that were sorted. Small number of student's experienced social circumstances put them on hold. Providing these students with clear and sincere advice did improve engagement and facilitated learning.

We designed 3 formative coursework-based assessments per module to promote deep learning and subsequently retention of concepts. This coursework format includes poster presentation, critical appraisal of keynote article, clinical scenarios where the students is asked to formulate a treatment plan supported by scientific evidence. The students were given a feedback on the first draft. The final draft was marked to give the final score with also a written feedback. We strongly believe that this form of assessment has a long-lasting outcome. This assessment strategy is suitable to assess performance and complex achievement. It emphasizes the integration of thinking and problem solving, which is the main ethos of this course. Learners must consider and design their response rather than recall the correct answer. This also allows direct assessment of other cognitive skills, critical analysis skills, information literacy and writing skills. We strongly believe that feedback is required even if there are no concerns to be addressed, the coursework was well done and there are no needs for any further improvement "everything is OK".

We focused our feedback on observable behavior such as writing style, reflection and implementation of the current evidence. This carries more weight and credibility to the students as highlighted by Gordon in 2003. We planned the feedback to be a dialogue between the student and tutor rather than monologue with the student at receiving end. In a distance learning course, students need much more explicit feedback than in a traditional course. There is a potential threat that these students feel isolated in their virtual world and may not engage properly. Narrative feedback was given formally and informally during and at the end of the course in writing and also by Skype calls or by Facebook messages. We avoided words that give sinking feeling and cause the student to switch off such as "poor" or "substandard". Narrative feedback is meaningful, explicit and more constructive as it highlights the positive as well as areas of improvement.

We also provided individualized and regular updates to each student on their performance. For example, contacting students praising them for their contributions to the web-based presentation encouraging them to contribute more. We contacted students who were not performing well to identify and resolve the problems they might be facing and to promote their engagement. Students were offered an opportunity to resubmit any substandard assignments to encourage reflection and subsequently deep learning.

Not surprisingly, when students failed the assessment and needed resubmission (7 students) it was not

because of lack of knowledge, but because of behavioral issues such as poor communication, inadequate reflection, poor academic writing and failure to engage during the learning process. The lack of personal insight into professional boundaries was a cause of concern in one student. Failure to demonstrate sound and professional implementation of the national guidelines is considered underperformance. We continually emphasized the need to implement the knowledge rather than just regurgitate information.

When we identified any signs of underperformance, usually lack of engagement was the first sign; we notified the student with our concern and tried to rectify the underlying factors before it resulted in an assignment failure. We advised the students to submit a draft before the final submission. This helped to rectify most of the underlying causes of under-performance. If students failed an assignment, more intense mentoring was instated with an escalation of the level of communication between the course faculty and the student to help achieving the learning objectives. Giving the international nature of this course (from 22 countries), this required availability outside the UK working hours. This course is aimed to facilitate the students to evolve and adopt skills of crucial decision-making so necessary for scientific analysis and learn from work-based reflective practice in their own clinical environment. We have already published the assessment of achievement of our objectives and students' satisfaction with this distance education in clinical medicine module. In this article, we have assessed at Kirkpatrick level 1 (i.e., reaction by end-term survey done only for module 1 of cohort 1), at level 2 (i.e., learning), at level 4 (i.e., change in behavior affecting organization) and at level 5 (i.e., return on investment). Level 3 has not been assessed yet because it is difficult to assess change in behavior of students at their work place.

### 3. Results

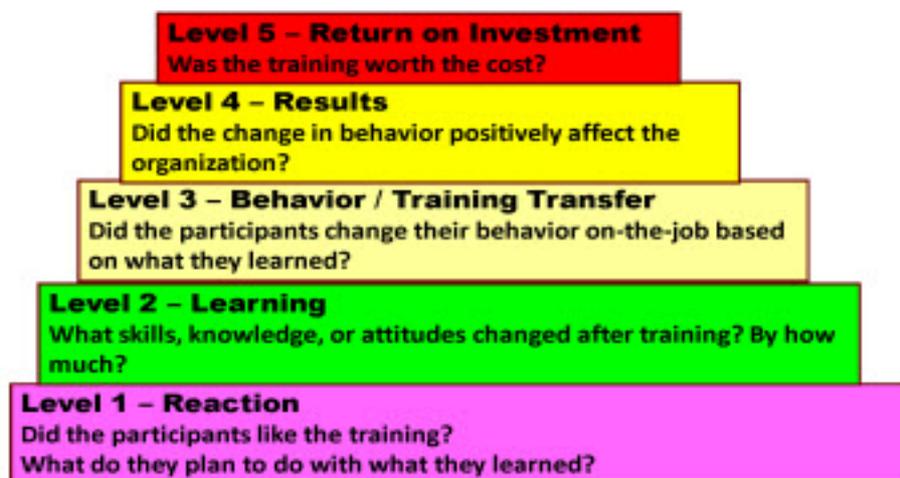
Students' survey (Kirkpatrick level 1) performed for module 1 of cohort 1 reported students' satisfaction rate of 93%. Excluding a total of 12 drop-outs from first cohort (n=10 in first cohort's module 1, and n=2 in module 2), as many as 93% of students of first cohort passed module 1 and 100% passed module 2 (learning Kirkpatrick level 2). Seven had to resit one or 2 assignments. Nine out of 60 registrants of module 1 in 2nd cohort took recess for one year requesting to join back as a part of 3rd cohort commencing one year later, all 51 who continued to study passed though 3 of them had to resit one or more assignment.

We promoted highly rated coursework to be published in peer-reviewed journals, also for abstracts based on excellent assignments to be submitted to international meetings. This is a real-time practical lesson teaching copyrights, academic honesty. It also promotes critical appraisal and summarization skills. The students realized that their effort would not be wasted encouraging them to work harder due to the added value of this published work to their careers. At the time of writing this article, 22 articles were published in peer-review journals and 15 abstracts were presented in international conferences at the time of writing this article based on module 1 and module 2 assignments of the first and the second

cohorts of students. This may help in promoting the international ranking of our institute that can be interpreted as equivalent to “change in behavior positively affecting the organization” (i.e., at Kirkpatrick level 4).

A total of eighty students passed module 1 and 2 from cohort one and module 1 in cohort 2 subscribed to next module (100% success rate). All those who passed module 1 (both cohorts) and 2 (1st cohort) registered for their respective next module (return on investment Kirkpatrick level 5). This can be interpreted as equivalent to “return on investment” (Kirkpatrick level 5), since it requires money and investment of time and effort. Without adequate evidence of “return of investment”, the students would not have enough drive to move to the next module.

End-term Survey to assess at Kirkpatrick level 1 for the first module of first cohort at the end of first module. 26 responded (93%). The survey covered the domains of organization, teaching, assessment and support and demonstrated excellent satisfaction (80% strongly agreeing, 20% agreeing with satisfaction in each domain. No student was unsatisfied with any of the items screened.



**Figure 1. Kirkpatrick Pyramid for Programme Evaluation (after Phillips 1996). ROI—Return On Investment**

#### 4. Discussion

This newly introduced online course is a great example demonstrating that it is an immensely useful tool to blend theory with clinical practice. It is possible to deliver high quality online clinical education provided that it is well designed and taking into account the student’s expectation and the educational needs of the tutors as suggested by Khaleghitabar and colleagues in 2016. The interactive nature, the most attractive aspect of this education, has allowed us to bridge the time and distance barriers to deliver high quality education as suggested by Edwards in 2016 and Thuméand colleagues in 2016. Meyer and Land (2005) explained usage of threshold concepts in a range of disciplines and educational contexts. Perkins (2006) emphasized that the critical thresholds are instrumental in understanding

trouble some knowledge that students must understand.

How does the faculty appreciate that the students have managed to understand critical threshold concepts of a topic (chapter) that has helped them to make crucial decision making when it comes to patient management? The faculty of this course has ensured close unceasing engagement with students in order to do facilitate them to negotiate through “stuck places” by “hand-holding” to let them move through “tricky bends” by developing skills of crucial decision-making necessary for scientific analysis. For unearthing “mysteries” of a specific topic, a professional should be able evolve a strategy of defining a pathway when they “stuck” in troubled waters or mire. Savin-Baden and colleagues (2007) describe the state of being clueless as a state of “stuckness”. Among many strategies that have been adopted as a very effective learning instrument in this course, the most important is for the faculty to appreciate where the students are lurking on the threshold of becoming a reliable and safe clinician who knows how to make correct logical decisions. This involves how to garner support from other clinicians such as the participants are asked to go and discuss with their own surgeons, physicians and radiologists in their own work-environment. This “e-cajoling” on e-blackboard nudges the students in to evolving mechanisms and standard operating procedures in their hospitals. A large number of participants (students) in this course do not have guidelines in dealing with key issues such as for living kidney donor work-up. By (a) participating in the discussions on e-blackboard, (b) meeting the colleagues of various specialties in their own hospitals, and (c) researching the best available recent scientific evidence, the compulsory course work included development of their own local guidelines very specific to their own challenges keeping in mind their local resources. This shows that the learning of crucial threshold is not limited to impressing other participants on e-blackboard, passing the assessment process but most importantly, changing their behavior and working style to enable effective decision making in managing their patients. This would not be possible without connecting the learning objectives to their patient management in day-to-day practice. Another effective learning instrument in adult learning that has been used in this course is: developing links between (a) the course material, and (b) their own current clinical experience. Quite often the students pose their own clinical questions when they are “stuck” in a clinical “stalemate”. By bringing their own clinical cases that have been managed well or not-so-well, the students have made use of virtual massive e-ward round on e-blackboard attended by 30-55 participants (they all are experienced clinicians whether as students or the course faculty) in accomplishing skills and evolved mechanisms that are absolutely necessary. By making them use reflective practice, the students who are lurking on the verge of crucial threshold of decision making in their own patient’s management, this course has had a profound impact on first two cohorts who have had no hesitation in registering for subsequent modules that requires them to commit paying course fee, spending time and putting in enough energy that are at premium for all the students as they are busy clinicians.

Moore’s theory of transactional distance highlighted that the perceived distance and perceived high level of isolation is a major hurdle in distance learning courses. Moore emphasized that the “active”

dialogue that is developed by the faculty and the resultant interaction with the learners bridges these gaps. Similarly, Shearer (2009) stressed the need for continuous refinement of evolution of “constructive dialogue” to engage the students cognition in distance learning. The faculty of this course appreciated that engagement of students, at times, needed a lot of effort. Current “techno-savvy” trend and the widely prevalent use of social networking in this era, that was not available in 1997 when Moore published the theory, has been put to its best use in actively engaging the students.

Boosting the curriculum with a wide range of experiences from the different UK and international centres underlined the educational value of the course. The multidisciplinary approach and the variety of educational tools used (audio lectures, bedside clinical scenarios, comprehensive multiple choice questions based on validated guidelines and high quality and leading articles) satisfied the needs of students and matched their learning style to achieve the learning objectives. The point of transformation is when the understanding threshold concepts transforms and deepens their view of specialty that leads to a change in behavior and approach to dealing with professional problems.

We used different tools to assess this model. End-of-the-term survey, the pass rate of those students who engaged with the learning process and the transition of all the students who passed the first module to the next module are convincing that education in clinical medicine still can be delivered in distance learning format. This approach in evaluation helped us to direct the education in the next modules.

## 5. Conclusions

Critical thresholds are crucial to understanding a subject and gaining expertise and, therefore, are key to aligning with learning objectives is a properly designed and blueprinted distance learning course. These are the corner stones of critical decision-making in safe and effective clinical practice, the main ethos of this unique totally on-line course in transplantation that delivers clinical education online. We strongly believe that adopting the principle of critical threshold while linking to theoretical knowledge and clinical experience in our pedagogy is the corner stone of success.

## References

- Galusha, J. M. (1997). Barriers to Learning in Distance Education. *Interpersonal Computing and Technology Journal*, 5(3), 6-14.
- Salmon, G. (2011). *E-moderating: The key to teaching and learning online* (3rd ed., pp. 1-144). New York: Routledge.
- Maria, N., Kevin, P., Gosselin, D. R., Peter, K., & Malcolm, A. (2015). Navigating learning journeys of online teachers: Threshold concepts and self-efficacy. *Issues in Educational Research*, 25(3), 319.
- Salmon, G. (2013). *E-tivities: The key to active online learning* (2nd ed., pp. 1-13). London and New York, Routledge.
- Robertson, M., & Al-Zahrani, A. (2012). Self-efficacy and ICT integration into initial teacher education

- in Saudi Arabia: Matching policy with practice. *Australasian Journal of Educational Technology*, 28(7), 1136-1151. <https://doi.org/10.14742/ajet.793>
- Shepherd, C., Alpert, M., & Koeller, M. (2007). Increasing the efficacy of educators teaching online. World Academy of Science. *Engineering and Technology*, 1(11), 426-432. Retrieved from <http://www.waset.org/publications/302/increasing-the-efficacy-of-educators-teaching-online>
- Airasian, P. W., & Russell, M. K. (2008). *Classroom assessment concepts and applications* (6th ed.). New York: McGraw Hill Higher Education.
- Linn, R. L., & Miller, M. D. (2005). *Measurement and assessment in teaching* (9th ed.). New Jersey, Pearson Prentice Hall.
- Pangaro, L., & Ten, C. O. (2013). Frameworks for learner assessment in medicine: AMEE Guide No. 78. *Med Teach*, 35(6). <https://doi.org/10.3109/0142159x.2013.788789>
- Gordon, J. (2003). BMJ ABC of Learning and Teaching in Medicine: One to one teaching and feedback. *BMJ*, 326(7388), 543-545. <https://doi.org/10.1136/bmj.326.7388.543>
- Huhta, A. (2010). Diagnostic and Formative Assessment. In S. Bernard, & H. Francis (Eds.), *The Handbook of Educational Linguistics* (pp. 469-482). Oxford, UK: Blackwell.
- Norcini, J. J. (2003). Work based assessment. *BMJ*, 326(7392), 753-755. <https://doi.org/10.1136/bmj.326.7392.753>
- Halawa, A. et al. (2017). How online coursework improves the attainment in clinical transplantation. *The Online Journal of Distance Education and e-Learning*, 1(5), 56-61.
- Kirkpatrick, D. L. (1967). Evaluation of Training. In R. Craig, & I. Mittlel (Eds.), *Training and Development Handbook* (pp. 87-112). New York: McGraw-Hill.
- Phillips, J. J. (1996). ROI: The search for best practices. *Training and Development*, 50, 42-47.
- Khaleghitabar, M. et al. (2016). Educational needs of faculty members of basic sciences of faculty of medicine: Educational and personal development needs. *Journal of Medical Education Summer*, 15(3), 115-123.
- Edwards, E. (2016). *5 Lessons for Designing Engaging E-Learning Interactions, from Project Runway*. Retrieved from <https://www.td.org/Publications/Blogs/Learning-Technologies-Blog/2016/02/5-Lessons-for-Designing-Engaging-E-Learning-Interactions-from-Project-Runway>
- Cien Saude Colet.* (2016). 21(9), 2807-2814. <https://doi.org/10.1590/1413-81232015219.14632016>
- Meyer, J. H. F., & Land, R. (2005). Threshold concepts and troublesome knowledge: Epistemological considerations and a conceptual framework for teaching and learning. *Higher Education*, 49(3), 373-388. <https://doi.org/10.1007/s10734-004-6779-5>
- Perkins, D. (2006). Constructivism and troublesome knowledge. In J. Meyer, & R. Land (Eds.), *Overcoming barriers to student understanding: Threshold concepts and troublesome knowledge* (pp. 33-47). New York: Routledge.
- Savin-Baden, M. et al. (2007). *Lurking on the threshold: Being learners in silent spaces Paper*

*presented at the Ideas in Cyberspace Education Ross Priory. Loch Lomond.*

Moore, M. (1997). Theory of transactional distance. In D. Keegan (Ed.), *Theoretical Principles of Distance Education* (pp. 22-38). Routledge.

Shearer, R. L. (2009). *Transactional distance and dialogue: An exploratory study to refine the theoretical construct of dialogue in online learning* (Doctoral dissertation). Retrieved from <https://www.eta.libraries.psu.edu/paper/10196/5490>