JMS Journal of Medical Science

A Thousand Words About Modern Medical Education: A Mini-Review Concerning the Theory of Education

Mustafa Hussein Ajlan Al-Jarshawi*
Nuffield Department of Clinical Medicine, University of Oxford, United Kingdom
Leicester Medical School, University of Leicester, United Kingdom
Department of Medicine, College of Medicine, University of Baghdad, Iraq
https://orcid.org/0000-0002-4600-2701

Ahmed Al-Imam*
Department of Computer Science and Statistics, Doctoral School, Poznan University of Medical Sciences, Poland
PUMS Doctoral School, Poznan University of Medical Sciences, Poland
Department of Anatomy, College of Medicine, University of Baghdad, Iraq
https://orcid.org/0000-0003-1846-9424

Corresponding author: tesla1452@gmail.com

* Equal contribution

DOI: https://doi.org/10.20883/medical.e636

Keywords: Theory of Education, Bloom's taxonomy, FAIR principles, Gagné theory of learning, Harden's ten questions, Miller's pyramid, Outcome-based education, SMART method, SPICES model

Published: 2022-05-20

How to Cite: Al-Jarshawi MHA, Al-Imam A. A Thousand Words About Modern Medical Education: A Mini-Review Concerning the Theory of Education. Journal of Medical Science. 2022;91(2);e636. doi:10.20883/medical.e636

ABSTRACT

The present article represents a mini-review and a reflective essay concerning modern medical education methods, as well as ways to adapt them to medical education's local conditions (disciplines), including basic medical sciences. We introduced Gagné's theory of learning and other theories – Constructivist, Experiential, and Humanistic – followed by Dennik's "twelve tips" for effective learning and Harden's ten questions for curriculum development. Outcome-based education (OBE) was discussed and related to relevant concepts within Miller's pyramid and Bloom's taxonomy. Harden's SPICES model was emphasized concerning education strategies while discussing the assessment of learning (AoL), assessment as learning (AaL), and assessment for learning (AfL). Finally, the authors advise exploring the adaptation of modern education methods for a specific discipline of basic medical sciences – Human Anatomy – by incorporating the above-mentioned concepts and integrating different AfL and AaL assessment tools while conveying a graphical concept map for this scenario.

Introduction

Gagné (1965) pioneered the "conditions of learning" theory and recommended that each teacher's instruction should have nine ingredients: gain learners' attention, share objectives with learners, activate prior knowledge, present learning material, provide guidance, elicit practice, convey feedback, assess performance, and enhance retention and knowledge transfer [1, 2]. Dennik (2012) debated that the overarching worlds of views about how learning happens –

Constructivist/Experimental, Behaviorist, and Humanistic – possess common elements which could guide teaching-learning practices. Dennik's "twelve tips" require activating prior learning, consolidating existing knowledge, promoting social constructs, deploying active learning, reflecting on learning, providing relevant experience, and promoting self-assessment. Furthermore, it mandates to amass mental models and practical skills, engage in hypothesis-testing and action-planning, respect-accommodate learners' needs, and rapport with them [3]. In 1986, Harden developed a "ten-questions" approach for a curriculum development to identify learning needs, define outcomes, choose and organize educational contents, pick educational strategies, select teaching methods, design assessment, organize curriculum communication, exploit the environment, and manage the curriculum. Moreover, he also created a "design-down process" from exit outcomes to phase, course, and lesson outcomes [4].

Outcome-based education (OBE) relates to Miller's pyramid, Bloom's taxonomy, and the SMART method. In 1990, Miller proposed a hierarchical framework for assessing learners; knowledge is at the very bottom (leaner knows), then competence (knows how), performance (shows how), and action (does) [5]. Nevertheless, Witheridge (2019) argued that Miller's pyramid-related assessment tools, e.g., OSCE/OSPE, had limitations concerning assessing diagnostic reasoning; therefore, they proposed a revised pyramid which integrates cognitive skills, including diagnostic reasoning [6]. In 1956, Bloom developed three hierarchical models to classify learning objectives into three domains: cognitive, affective, and sensory [7]. Bloom's cognitive domain – which relates to Miller's pyramid – has a six-tier hierarchy of low-to-high order cognitive skills (knowledge, comprehension, application, analysis, synthesis, and evaluation) [8]. On the other hand, the SMART method aims at well-defined learning outcomes (specific, measurable, attainable, relevant, and time-bound) [8, 9].

In terms of the curriculum contents, it mandates three phases: before (prerequisites), during, and after (future learning), whereas teaching methods should correspond to high-retention rates within the learning pyramid, via which it is possible to progress from passive to active learning and from visual-auditory to kinesthetic learning experience (**Figure 1**). [4, 10]. In 1984, Harden pioneered the SPICES model for educational strategy, which refers to six elements, and each has a continuum, including student/teacher-centered, problem/information-based, integrated/discipline-based, community/hospital-based, electives/standard program, and systematic/apprenticeship-based [11].

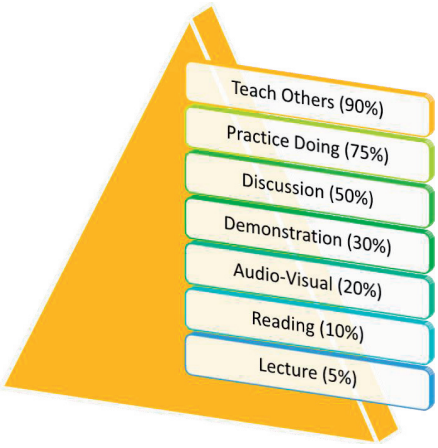

Figure 1. The learning pyramid: Teaching methods and retention rates

Learning assessment can be challenging, and teachers visualize it from learning outcomes to teaching activities to assessment via constructive alignment; in contrast, students' perspective is reversed [4, 5]. Instructive alignment relates to the "golden triangle" – objectives, assessments, and instructional methods promote educational outcomes [8]. Archetypally, assessment was an evaluation "of" learning (AoL); however, a programmatic assessment should be "for"/"as" learning (AfL and AaL) to steer learners towards maximum potential by evaluating learning dimensions to optimize learning and educational decision-making [4, 5, 12]. Schuwirth (2011) demanded novel psychometric models and human judgment for robust assessment; he also emphasized an "N:N relationship" instead of a "1:1 relationship" with regard to assessment instruments, i.e., an assessment tool should map, or inform on, more than one competency domain [13]. AfL evaluates competencies and identifies gaps and confusions; it can be diagnostic (map prerequisites), formative (guide-maintain regular learning), and summative, while AaL requires meta-

cognition with learners critically analyzing new information, relating it to their prior knowledge and experience, and investing it for future learning and practical application [14].

Harden and Laidlow (2012) emphasized assessment "as" learning by introducing the FAIR principles (**Figure 2**), in which a teacher should incorporate feedback to learners, conduct active learning, individualize the learning process according to learner's needs and abilities, and ensure relevant learning; these principles evaluate learners' competencies and deficiencies, identify best learners, motivate others, and promote teacher's competence [12]. In fact, FAIR's most challenging element is the individualization principle which relates to Guttman's scale according to which students vary in terms of their abilities to learn or to solve simple to complex problems[15]. AfL and AaL should accompany each tier of Miller's pyramid; educators must use factual tests (knowledge), clinical-based tests (competence), controlled environment tests (performance), and real-life tests or scenarios (action) [5, 6]. Practical assessments include OSCE/OSPE, MINI-CEX, 360-degrees assessment, and Portfolios, while written forms, addressing lower tiers of Miller's pyramid, include MCQs, true/false questions, matching/extended-matching, fill in the blanks, short-answer, and essay questions; nonetheless, each has advantages and disadvantages [14]. In 2010, Cook conveyed "twelve tips" for the holistic evaluation of educational programs – his third tip stresses the difference between assessment and educational program evaluation [16].

In 2003, Hutchinson debated that good educators can optimally maneuver their educational environment, while the environment and learners' interaction determine learners' motivations, tasks perception, and relevance. Thus, educators should maximize the physical environment and ensure adequate spacing-seating, comfortable climate, minimizing distractions/noise, and utilize audiovisual equipment [17, 18]. Learners' motivation is pivotal, and it relates to the educational environment and Maslow's hierarchy of needs – physiological needs (base), safety, belonging, self-esteem, and self-actualization (top) (**Figure 3**) [19].

As far as adopting modern medical education methods and techniques to a specific disci-

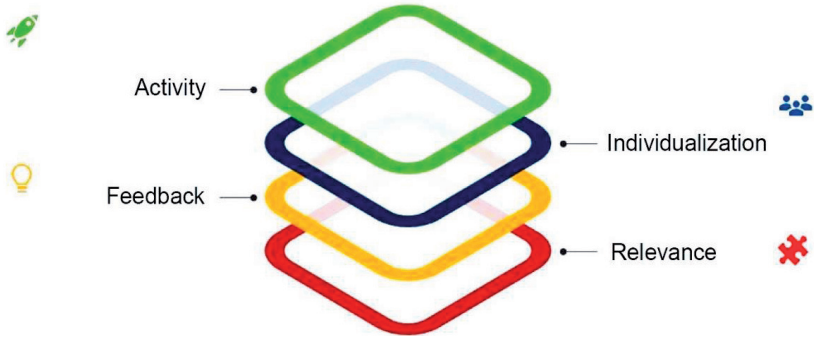

Figure 2. FAIR Principles for assessment as learning (AaL)

Figure 3. Maslow's hierarchy of needs

pline is concerned – human anatomy in the case of the present paper – the authors recommend implementing Harden's "ten questions", Gagné's recommendations on teachers' instructions, and OBE in congruence with Miller's pyramid and Bloom's taxonomy while utilizing the SMART and SPICES models customized for each institution's requisites (**Figure 4**). Furthermore, medical educators can aim for programmatic AfL and AaL by integrating FAIR principles and optimum maneuvering of the physical elements of the educational environment in accordance with Maslow's hierarchy of needs. Nevertheless, anatomy teachers may still experience difficulties within the holistic education process, due to the fact thatanatomy is an intricate subject which mandates phasic assessment (diagnostic, formative, and summative) and multi-mapping (N:N) of the competency domains, including theoretical and clinically-oriented knowledge, three-dimensional anatomical appreciation, cadaveric dissection or its virtual simulation, as well as cognitive-diagnostic reasoning in the clinical context. For instance, combing demonstrator-assisted cadaveric dissection with virtual simulations of anatomical models in our instructional design of teaching applied anatomy could draw on both constructivist views regarding learning, particularly Vygotsky's theory in working with learners at their zone of proximal development [20], and the behaviorist doctrines according to which learning happens only in the course of in situ observation, i.e., Bandura's cognitive theory of social learning [21].

Acknowledgements

Ahmed Al-Imam is a participant in the STER Internationalisation of Doctoral Schools Programme from NAWA Polish National Agency for Academic Exchange No. PPI/STE/2020/1/00014/DEC/02.

Conflict of interest statement
The authors declare no conflict of interest.

Funding sources
The authors self-funded the study. Ahmed Al-Imam received funding – a research grant – from statutory funding for young scientists in 2021–2022. However, he did not use the grant's money to fund or pay for its publication charges.

References

1. Rourke L, Leong J, Chatterly P. Conditions-based learning theory as a framework for comparative-effectiveness reviews: A worked example. Teaching and Learning in Medicine. 2018;30(4):386–94. Doi: 10.1080/10401334.2018.1428611.
2. Tambi R, Bayoumi R, Lansberg P, Banerjee Y. Blending gagne's instructional model with Peyton's approach to design an introductory bioinformatics lesson plan for medical students: proof-of-concept study. JMIR Medical Education. 2018;4(2):e11122. Doi: 10.2196/11122.
3. Dennick R. Twelve tips for incorporating educational theory into teaching practices. Medical Teacher. 2012;34(8):618–24. Doi: 10.3109/0142159X.2012.668244.
4. Sattar K. Ten questions to be answered before incorporating problem-based learning (PBL) into professionalism course. Education in Medicine Journal. 2019;11(1):59–69. Doi: 10.21315/eimj2019.11.1.8.
5. Al-Eraky M, Marei H. A fresh look at Miller's pyramid: assessment at the 'Is' and 'Do' level. Medical education. 2016;50(12):1253–7. Doi: 10.1111/medu.13101.

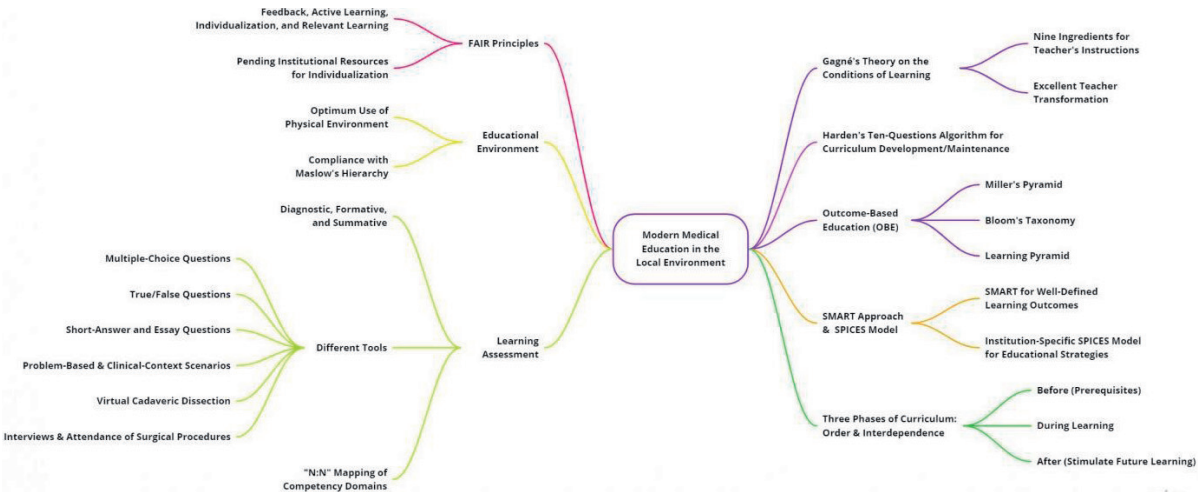

Figure 4. Concept map of modern education in local conditions

6. Witheridge A, Ferns G, Scott-Smith W. Revisiting Miller's pyramid in medical education: the gap between traditional assessment and diagnostic reasoning. International Journal of Medical Education. 2019;10:191–92. Doi: 10.5116/ijme.5d9b.0c37.
7. Adams NE. Bloom's taxonomy of cognitive learning objectives. Journal of the Medical Library Association. 2015;103(3):152. Doi: 10.3163/1536-5050.103.3.010.
8. Chatterjee D, Corral J. How to write well-defined learning objectives. The Journal of Education in Perioperative Medicine. 2017;19(4):E610. PMID: 29766034.
9. Wong G. Is SMART really smart?. Education for Primary Care. 2014;25(2):76–7.
10. Stevenson R, Moore DE. Ascent to the summit of the CME pyramid. Journal of the American Medical Association. 2018;319(6):543–4. Doi: 10.1080/14739879.2014.11494250.
11. Wijnen-Meijer M, Van den Broek S, Koens F, Ten Cate O. Vertical integration in medical education: the broader perspective. BMC Medical Education. 2020;20(1):1–5. Doi: 10.1186/s12909-020-02433-6.
12. Harden RM, Laidlaw JM. Be FAIR to students: four principles that lead to more effective learning. Medical Teacher. 2013;35(1):27–31. Doi: 10.3109/0142159X.2012.732717.
13. Schuwirth LW, Van der Vleuten CP. Programmatic assessment: from assessment of learning to assessment for learning. Medical Teacher. 2011;33(6):478–85. Doi: 10.3109/0142159X.2011.565828.
14. Schellekens LH, Bok HG, de Jong LH, van der Schaaf MF, Kremer WD, van der Vleuten CP. A scoping review on the notions of Assessment as Learning (AaL), Assessment for Learning (AfL), and Assessment of Learning (AoL). Studies in Educational Evaluation. 2021;71:101094. Doi: 10.1016/j.stueduc.2021.101094.
15. Harden RM, Laidlaw JM. Be FAIR to students: four principles that lead to more effective learning. Medical Teacher. 2013;35(1):27–31. Doi: 10.3109/0142159X.2012.732717.
16. Cook DA. Twelve tips for evaluating educational programs. Medical Teacher. 2010;32(4):296–301. Doi: 10.3109/01421590903480121.
17. Hadie SN, Yusoff MS, Arifin WN, Kasim F, Ismail ZI, Asari MA, Hassan A, Muda TF, Bakar YI, Zamin RM, Ramli ES. Anatomy Education Environment Measurement Inventory (AEEMI): a cross-validation study in Malaysian medical schools. BMC Medical Education. 2021;21(1):1–12. Doi: 10.1186/s12909-020-02467-w.
18. Vanka A, Hovaguimian A. Teaching strategies for the clinical environment. The Clinical Teacher. 2019;16(6):570–4. Doi: 10.1111/tct.12928.
19. Hale AJ, Ricotta DN, Freed J, Smith CC, Huang GC. Adapting Maslow's hierarchy of needs as a framework for resident wellness. Teaching and Learning in Medicine. 2019;31(1):109–18. Doi: 10.1080/10401334.2018.1456928.
20. Bandura A, Ross D, Ross SA. Transmission of aggression through imitation of aggressive models. The Journal of Abnormal and Social Psychology. 1961;63(3):575–82. Doi: 10.1037/h0045925.
21. Vygotskiĭ L. Mind in society. 1st ed. Cambridge, Mass.: Harvard University Press; 1978.