RESEARCH ARTICLE

A CREATIVE approach to designing a contemporary medical curriculum [version 1]

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Abstract
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In medical education, Outcome-based Education (OBE) is facing many challenges due to the rapid proliferation in biomedical sciences; technology-enhanced learning; globalization of health system, and the availability of various pedagogical techniques. A steady stream of evidence-based developments challenges those who are responsible for sustaining and improving their medical curricula. Curriculum reform is a dynamic process and there is no explicit approach that can serve as a guide for a curriculum reviewer while making amendments in the OBE integrated curriculum. This study took place in a medical college in Saudi Arabia and it highlights the key components to be considered while reviewing the Bachelor in Medicine and Surgery (MBBS) course specifications and curriculum. It suggests the importance of course reports as the main driving force for curriculum reforms. Delineating major and minor changes in the curriculum and frequency of amendments in course specifications also remains a questionable task and requires established institutional guidelines. Furthermore, based on practical experience in the periodic curriculum review process, the authors suggest some best practice. We present a "CREATIVE" way forward which we have found invaluable, both for curriculum developers and for engaging with our stakeholders. This mnemonic spells out the key factors to consider while revisiting the curriculum from various angles. These factors are: Course Report recommendations, Evaluation tools (internal and external), Alignment of pedagogical strategies with assessment, Technology, Innovation, V...
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Variations in the learning environment, and Establishment of institutional guidelines. Application of these fundamental elements allowed us the development of a curriculum that meets the standards for international accreditation and helped the institution to form a cohesive team of educationalists.

Keywords
Outcome-based Education (OBE), SPICES based integrated curriculum, contemporary medical curriculum, Medical education, curriculum evaluation, OBE Integrated curriculum review and reforms
Introduction
In the current era, Outcome-based Education (OBE) faces many challenges due to the rapid proliferation in biomedical sciences; technology-enhanced learning (TEL); globalization of the health system, and the availability of various pedagogical techniques. In medical education, a steady stream of evidence-based developments challenges those who are responsible for sustaining and improving their medical curricula.

The change in the educational environment demands training of medical graduates in the curriculum, which is more enriched to instil the spirit of teamwork, collaboration and value communication skills and professionalism during patient care. There is also a demand to create an educational environment which is friendly, relaxed and that guides the physicians to overcome the stressful events in complex situations by promoting the self-awareness (Elder et al., 2007).

The Problem
A wide range of literature argues for the demand for curriculum reorganisation and claims that curriculum reform is a dynamic process (Cate, O. ten, 2007; Snelgrove et al., 2009). However, there is a lack of exploration of the evaluation processes and guidelines on the review of the curriculum. There is no explicit approach, which can serve as a guide for curriculum reviewers while making amendments in the OBE integrated curriculum. Moreover, we have chosen the SPICES framework to help our thinking about the key implications for medical curriculum development in the context of Outcomes-based Education. This term is abbreviated for; student-centred, problem-based, integrated, community-based, elective and systematic approach (Harden, 2000).

There must be evaluation tools and policies at institutional levels, which guide the reviewers, faculty members, decision-makers and stakeholders to adopt these changes thereby progressing transformation in the educational environment effectively (Harden, 2002). There is an intense demand to regularly revisit the curriculum with multifocal lenses. Besides, there is a requirement to craft an approach to revise the OBE model in medical education undergraduate’s curriculum in order to ensure the ownership and decrease resistance to change in the curriculum (Elizondo-Montemayor et al., 2008).

Furthermore, the medical educators are struggling to implement, stabilise, and sustain OBE, however, the extent to which the planned outcome-based curriculum has been applied successfully needs a robust evaluation method (Changiz, T. and Yousefy, A., 2006). There is a prerequisite of a standard model or paramount gauge to ensure the application of outcome-based education (Harden, 2007b; van den Berg, 2004). In addition, there are specific requirements to evaluate the pedagogical methods enhanced by technology in order to establish the sustainability of TEL in medical education (Cook and Ellaway, 2015).

In addition to the educational imperatives above, a range of treatment modalities amalgamated with advanced technologies, for example, robotic surgery, artificial intelligence and telepresence enforce modification of the curriculum content, employment and assessment plans (Harden, 2007a). Finally, social accountability and the psychological, societal & cultural diversity in the practising community impose the curricular reforms (Cuff and Forstag, 2019; Quintero, 2014).

This article addresses the practice of OBE integrated curriculum of medical instruction, at a medical college in Saudi Arabia. It highlights the key components to be considered while reviewing the Medicine and Surgery (MBBS) degree specifications and curriculum as a whole. It discusses the driving forces for curriculum manipulation and pinpoints the leading influences for curriculum management. It highlights the impact and consequences of decisions taken in view of recommendations made by stakeholders of the curriculum. Moreover, based on practical experience in the periodic curriculum review process, the authors suggest best practice points. In this article, we present a “CREATIVE” way forward which we have found invaluable, both for curriculum developers and for engaging with our stakeholders (Figure 1). The CREATIVE mnemonic spells out the key factors to consider while revisiting the OBE and guides the reviewers to look into the curriculum from various angles. These factors are: Course Report recommendations, Evaluation tools (internal and external), Alignment of pedagogical strategies with assessment, Technology, Innovation, Variations in the learning environment, and Establishment of institutional guidelines. Application of these fundamental elements allowed us the development of a curriculum that meets the standards for international accreditation and helped the institution to form a cohesive team of educationalists. Moreover, it can be applicable for other professional OBE curriculum as well as the medical profession.

Methods
An intuitive approach to Outcome-based Education (OBE)
Alfarabi College of Medicine in Saudi Arabia offers a Bachelor in Medicine and Surgery (MBBS) programme of 212 credits, full time delivered over six years. We follow a competency/outcome-based curriculum built on
the SPICES model (Harden, 2007a). Here, specific learning outcomes provided by the Saudi Medical Education Directives (SaudiMED), act as a driver for curriculum planning (Ali et al., 2013; Awan et al., 2018). SaudiMED framework of competency-based medical education is applied to most of the medical schools of Saudi Arabia. The stakeholders of SaudiMED work in coordination with the National Commission for Academic Assessment and Accreditation (NCAAA) and serve as a national benchmark for MBBS curriculum at Saudi Arabia. This model addresses the needs of society to produce competent medical practitioners with knowledge, attitudes, skills and ability to apply them in real-world practice (Snell & Frank 2010). The framework is considered similar to the CanMEDS framework; established by the Canadian Royal College of Physicians and Surgeons in 1996 (Shadid et al., 2019). CanMEDS is a framework that describes the abilities physicians require to effectively meet the health care needs of the people they serve. These abilities are grouped under the following seven roles: medical expert, collaborator, communicator, health advocate, leader, scholar, & professional.

A set of educational theories based on evidence underpin our curriculum. These theories include the learner-centred approach, self-directed learning, and theories of professional practice (teamwork, ethics, effective communication) (Kaufman, 2003; Lindgren et al., 2011). In addition to this, inspiration has been derived from reflective practice, constructivism, and professionalism (Frank et al., 2010).

Our vision is to be a leading medical school in the Middle East region with dedicated continuing education development and to be internationally renowned for high-quality education. Our institution is keen to utilize well-qualified staff that provides significant and high-quality medical education using top-class, modern facilities.

### Curricular Design

The MBBS curriculum is characterised by integration, both horizontal and vertical throughout the programme. Basic medical sciences run from the beginning of the program in the form of system-based integration until the end of year three (Brauer and Ferguson, 2015). Horizontal integration involves the division of basic sciences into various organ systems of the body. Vertical integration involves an early introduction to clinical skills, professionalism, ethics, evidence-based medicine and research through problem-based learning; seminars which focus on real-life clinical scenarios; community interaction and clinical placements. We employ the Z-model of curriculum integration where clinical sciences are considered alongside the basic sciences early in the curriculum and increase in relative importance. We have developed the curriculum according to the SPICES framework to make learning activities more student-centred, problem-based, integrated, community-based, elective-based and structured (Harden, Sowden and Dunn, 1984).

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**Figure 1. Implementation inventory suggests to follow “CREATIVE Approach” OBE integrated curriculum**

| Course Report recommendations | Evaluation tools | Alignment | Technology | Innovation | Variations | Establish |
|------------------------------|-----------------|-----------|------------|------------|------------|-----------|
| Quality feedback by students | Self-study reports | Direct evaluation | Educational strategies | Assessment tools | Adaptive learning | Monitoring skills |
| Change in content | Change in learning & teaching | Change in learning & teaching | Change in learning & teaching | Change in learning & teaching | Change in learning & teaching | Change in learning & teaching |
Results/Analysis

The OBE integrated curriculum planning and implementation need review process periodically. This study mentions the best practice points and recommendations on the basis of a detailed review of the curriculum over a period of four years (2015-2019) during eight cycles of OBE integrated curriculum analysis. The corresponding author’s key position and involvement in the curriculum review cycle; being an expert curriculum developer and chair of the Curriculum Management Committee (CMC) ascertain the employment of these recommendations in the OBE integrated curriculum. Most of the decisions within the course specifications about content mapping, applied pedagogical methods and schedules are devolved to course directors and content experts, who specify the appropriate pathways for reviewers to institute the final plans for curriculum.

Discussion

Course Report Recommendations

Course reports analysis supports the evaluation of the successful application of courses and conveys the dynamics of the whole programme comprehensively. These recommendations provided key improvements in the courses and served as the main driving force to upgrade the whole curriculum map as shown in figure 2. For instance, in the pre-clerkship phase (Year 1-4), we observed that few hard courses (Neurosciences, in level 6) were delivered before the basic body systems (Musculoskeletal course, in level 7). As a result, the student’s performance and scores in the neuroscience course were inadequate. Therefore, the course director prompted the directives in the curriculum map and consequences of this change were reflected positively in the subsequent years, particularly student performance in the formative and summative results. Student satisfaction was enhanced with this alteration as was effective curriculum mapping, which was imperative to coordinate the whole curriculum (Harden, 2001).

Student feedback by the end of each course was highlighted in the course reports. Their opinions and voice were supported by evidence. The analysis of their feedback helped to make amendments in the schedule, effective integration of content, timetables, teaching methods and assessments strategies. For example, learning in small groups and PBL discussions were perceived as more effective than lectures. This helped the course directors to work with course specifications to build more task-based, student-centred and teamwork activities. Moreover, they recognized the assessment tool which aligns with objectives and teaching plans, was based on this feedback.

Using the analysis of student’s formative and summative assessments, content experts determined how to modify the course prerequisites and co-requisites. For instance, in the original curriculum plan, a pharmacology course was not a prerequisite for body system courses. Including the pharmacology course before the body systems courses improved student understanding, confidence and examination result both for pharmacology and the body systems courses. It also resulted in very positive feedback from the students.

Figure 2. Course Reports recommendations; the main driver to modify learning/teaching strategies and assessment plans
For quality assurance, the introduction of a quality unit helped to enhance the quality of courses. Their remarks provided a coherent and panoramic view of individual courses and programme on the whole.

Evaluation Tools

Self-evaluation by using self-study report could be used as a tool for OBE integrated curriculum. The application of the self-study report under the supervision of the quality unit helped to assess our progress in the programme itself and prompted to bridge the gaps in the applied curriculum. The self-reflection to enhance the OBE integrated curriculum was appreciated by faculty and students. Moreover administrative issues, for instance, logistics, resources, manpower, technology support; were highlighted by reviewers. These concerns were presented to stakeholders and refinement of shortcomings in the programme, were evaluated to enhance the delivery of the curriculum.

Internal and external review by the Centre for Medical Education team from Hampton UK (CenMEDIC) helped to augment the quality of curriculum delivery (Walsh, 2013). This aspect of evaluation prepared the institution for accreditation of the MBBS programme by governing authorities (SaudiMed), which included institutional recognition in the higher education sector.

Constructive Alignment

The course reports highlighted the percentage of achievements of each learning objective in three learning domains (cognition, psychomotor skills and attitude) assessed by different assessment tools (single best answers, very short answer questions, objective structured clinical skill exams, practical and logbook evaluation). This microscopic evaluation served as a corrective instrument to constructively align the individual course specifications, therefore this approach cultivated the OBE integrated curriculum by lining up the programme learning objectives, teaching strategies and assessment plans (Essary and Statler, 2007; Harden, 2001).

Moreover, modifying assessment strategies in the form of reflective practices in clinical courses and the introduction of team-based learning (TBL) was promoted. As a result, there was an introduction to the use of reflective journals in the clinical courses, especially in clinical and elective courses. Consequently, the reflective writing skills for learners were improved. Similarly, critical thinking stimulated deep learning among the students, in addition to identifying deficiencies and further learning goals (Majid, 2016).

Technology

Currently, the cutting edge technological revolution in the educational environment, digitalization of learning management, and the introduction of 3D virtual reality (VR) have prompted an upgrade of the curriculum. The unique concept of telepresence and telemedicine will reshape future medical institutions. It will not only remodel the medical schools but also modernize the pedagogical techniques. The use of audience response systems (ARS), interactive lecturing, videos, different polling software, and artificial intelligence (AI) has created a stimulating and engaging learning environment. Therefore, the progression to adaptive and mastering learning ought to be encouraged, stimulated in the form of test-enhanced learning to uphold cognition & clinical skills (Larsen, Butler and Roediger, 2008).

Moreover, the high fidelity simulators have helped to expand clinical skills and mastering learning (Issenberg et al., 2005; Maran and Glavin, 2003). Hence, the curriculum featured advanced simulators and technology, which was encouraged by reviewers. Convincingly, these activities were duly supported by learning management portals, technology-enhanced multiple quizzes, blended learning, and audience response systems in the MBBS programme.

Innovation

With the passage of time, the OBE integrated curriculum is developing an innovative approach in order to enrich the quality standards of higher education. There was a great concern for developing collaboration among medical institutions nationally and internationally during the review process of three years. We have taken the initiative to develop partnerships with other medical institutions to help review, develop and implement our joint visions for improving medical education (Cate, O. ten, 2007).

Additionally, there is a trend to adopt the curriculum and the methods of delivery which promote learner curiosity. It is evident that curiosity endorses deeper learning and engagement in the learning process (Schmitt, F. F. and Lahroodi, R., 2008). The aspect of dissonance in problem-based learning and well-structured cases scenarios enhance the learner
to think critically and logically. Our reviewers suggested and agreed to promote curiosity in learning and teaching and to provide faculty development to train staff to promote curiosity in teaching (Pluck, G., & Johnson, H., 2011).

**Variations**

There were some factors that had a significant impact on the applied courses within the curriculum, such as the number of part-time and adjunct faculty, a cohort of low achievers within the student body, a lack of trained faculty, and lack of resources. During a patch of unfavourable circumstances, it was decided that there must be an institutional policy to embrace such challenging situations. Such disruption must not affect the planned and applied curriculum. Therefore, it was argued to adapt change gradually and any disruption in the educational cycle and interference in curriculum change ought to be steady.

**Establish principles and nurturing the learning environment**

In order to ensure the applicability and sustainability of OBE integrated curriculum, the authors strongly recommended developing the policies and procedures for curriculum review at the institutional level. This was prescribed on the development of standard operating procedures (sops) for curriculum review. However, it remained a debatable issue that how often and how far the curriculum can be amended during its implementation. Moreover, how to define the major and minor changes in the curriculum needed further exploration.

It was critically reasoned during the review process that when the system forces teachers to teach the test, we are narrowing down the learning to the core part of the subject to get through the exams. As a result, there is a stressful situation and actually, this is not helping learners much. We need to prepare students for lifelong learning, not just for the exams; which underpins the OBE integrated curriculum. Hence, there must be an exciting space and real value of self-directed learning and directed self-learning in the programme.

There is intense demand for curriculum which instigates interest and boosts the intrinsic motivation in students, including autonomy support, adequate feedback, and emotional support (Kusurkar et al., 2012). The assessors supported and applied the idea of academic mentorship in order to strengthen the academic support system and enhance emotional intelligence (Cherry et al., 2014). There was special consideration given to students with low achievement and potential dropouts, by offering extra office hours and academic support. Moreover, in a few courses, there was a switch to task-based learning (TBL) to promote effective communication and time management skills in the learning environment by challenging the learners.

In the health care profession, there is significant stress and burnout due to performance in complex and diverse situations because of multi-tasking and high stake decisions, especially in emergencies. This can lead to a lack of self-awareness, psychological discomfort, and cognition distress in medical professionals. Therefore, these conditions provoked the medical educators to engage with a curriculum, which guides the learner, to stay calm in a tough situation and promote the self-awareness (Cherry et al., 2014). The physiologic benefits of meditation programme in medical education have been proved very operative (MacLaughlin et al., 2011). Some authors advocate that it’s time to establish the medical curriculum by introducing a few courses which encourage mindfulness to nurture the healthy working environment (Cuff, 2019; Elder et al., 2007).

In short, other authors have suggested fostering a learning environment, which is friendly, collaborative, flexible; because such an atmosphere will help the apprentices to explore their hidden potential (Genn, 2001). As a result, it may generate innovations in the medical profession and cultivate the talent of budding physicians through the enhancement of emotional intelligence to investigate beyond the boundaries of the health profession.

Finally, the authors suggested that institutions should create an enthusiastic, engaging, and passionate learning environment and enjoy the real pleasure of Diffendoofer Day; a charming story of a school where learners relish their learning in the unperturbed way (Carey, 2011).

**Conclusion**

This article addresses the main driving forces for curriculum management and recognises the leading influences for curriculum organisation in view of cutting edge developments in biomedical sciences; technology-enhanced learning; globalization of the health system, and the availability of various pedagogical techniques. It highlights the impact and consequences of decisions taken, in view of recommendations made by stakeholders of the curriculum. Course reports recommendations and evaluations serve a major role in proposing the modifications in the course specifications and curriculum map.
Defining major and minor changes in the curriculum remains a grey area. Moreover, how often to make the amendments in course specifications based on course reports recommendations remains a disputed question and needs the establishment of institutional guidelines. The authors presented a “CREATIVE” way forward which we have found invaluable, both for curriculum developers and for engaging with our stakeholders. This prompt spells out the key factors to consider while revisiting the OBE integrated curriculum and guides reviewers to look at the curriculum from various dimensions. These factors are: Course Report recommendations, Evaluation tools (internal and external), Alignment of pedagogical strategies with assessment, Technology, Innovation, Variations in the learning environment, and Establishment of institutional guidelines. Implementation of these fundamental elements allowed us the development of a curriculum that meets the standards for international accreditation and helped the institution to form a cohesive team of educationalists.

Take Home Messages
- Appraisal and evaluation of an OBE integrated curriculum is very challenging in view of evidence-based practices, rapid reforms in pedagogical techniques and technology
- Curriculum review assists to identify the loopholes in the integration of basic and clinical sciences and helps to break the barriers for true assimilation of curriculum
- Course reports recommendations function as the main way to propose modifications in the course specifications and curriculum map
- Delineating major and minor changes and frequency of amendments in course specifications remains a questionable task
- We propose “CREATIVE” approach while reviewing and reforming the curriculum on the grounds of best practice evidence

Notes On Contributors
This study was supported by the Research Unit, Alfarabi College of medicine Riyadh.

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

Ethics Statement
At Alfarabi College of Medicine, this research was approved from ethical approval members dated on 17.09.2019 CMC#01091719. The research was conducted from September, 2016, through September, 2019 in accordance with the Declaration of Helsinki.
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Figure 1: Author Dr Shazia Iqbal is the creator/owner.

Figure 2: Author Dr Shazia Iqbal is the creator/owner.

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Mohamed Al-Eraky
University of Dammam

This review has been migrated. The reviewer awarded 2 stars out of 5

Thanks for sharing this interesting article. I was captured by the CREATIVE title. Authors may need to indicate a specific application/uses for their CREATIVE model, either in curriculum design, development, mapping, analysis, review or evaluation. The model needs to be discussed in view of other related frameworks, such as: SPICES1, Curriculum Navigator2, PRISM3 or the Stufflebeam's CIPP4 Models. There was a brief reference to the SPICES model, but without correlation with the suggested one to build a strong argument for the need of a new model. The description of the current curriculum needs further elaboration. For instance, if the MBBS curriculum of Alfarabi College is ‘integrated’, to which extent on the integration ladder5? The Methodology was not clear to me. How the authors come up with their model? In the Discussion, many of the recommendations were generic. For instance, “fostering a learning environment, which is friendly, collaborative, flexible”. Authors needs to educate readers and scholars on when, how and what to expect when using their CREATIVE model in their context. I hope my feedback would help you to apply your model in real practice. Good luck!

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Competing Interests: No conflicts of interest were disclosed.
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Trevor Gibbs
AMEE

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

Although I enjoyed reading this paper, I did find it very difficult to read and understand because of its lack of flow and logical approach. I was not sure initially whether the authors were suggesting the CREATIVE approach to all curricula review or that they had created these CREATIVE headings to review their curriculum. There were many points where the authors adopted a very superficial approach, mentioning particular areas of researched approaches but I was not sure they applied them to their curriculum or wanted to do them at a later date. The authors spoke strongly of an Outcomes-Based Curriculum, but I was unclear how the CREATIVE approach matched specific LOs - examples would have helped here. I think that the authors had not looked at the evaluation from the users of the system i.e. employers to evaluate the programme. Like my co-reviewer an overview of the curriculum would have been helpful. All is not lost however in this piece of research. An improvement in flow and clarity of the paper, using more specific examples, connecting change to findings from evaluation and exploring more effectively the early and later outcomes (the results) would all improve this paper and make it more useful for all curriculum developers.

Competing Interests: No conflicts of interest were disclosed.

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P Ravi Shankar
American International Medical University

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

I enjoyed reading this manuscript about the CREATIVE approach to curriculum management and
evaluation. Rapid developments in a number of areas underlines the importance of a dynamic and responsive curriculum. The authors have identified technological change, telepresence, telemedicine and the development of artificial intelligence as important challenges. They have described the process of curriculum review at the institution in detail. They refer to the basic sciences curriculum a number of times in the paper. Readers may find it helpful if an outline of the overall and the basic sciences curriculum is provided. The authors refer to a number of issues in the manuscript. The paper reads a bit disjointed in certain areas as diverse issues are addressed briefly. The authors have addressed a number of vital areas in the modern medical curriculum which can be of benefit to curriculum developers and educators. I was not able to find mention of a curriculum management system in the manuscript. I am also not sure about when the medical school was started. Inputs from alumni and from employers of graduates can also provide valuable inputs regarding the curriculum.

**Competing Interests:** No conflicts of interest were disclosed.