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Commentary

# The ASIC Framework: An Alternative Operational Matrix to Support the Technology and Innovations in Medical Education based on the Primary Learning Domains

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## ABSTRACT

Educational technology and innovations as well as creative approaches to teaching, learning, and training have become increasingly integral to the delivery of medical education. Arguably, the COVID-19-related challenges of the years 2020-2022 would mark a watershed point in terms of the integration of digital technology and innovations into education, especially medical education. This article presents an operational matrix, aligned with learning in the primary domains, namely cognitive, psychomotor, and effective domains, to support the medical education-associated technology and innovations. It is therefore named the ASIC-CPA operational matrix or the alternative ASIC Framework operational matrix relative to the originally developed and published matrix. Accordingly, the ASIC Framework has been developed, as a foremost instrument to ensure the adaptation, standardisation, and integration of technology in compliant ways. An operational tool or matrix is conducive to ensuring that this ASIC Framework could be used in the most beneficial ways. This article presents an operational matrix that has been developed with emphasis on how EdTech and innovations influence learning in the domains of knowledge or the cognitive, skill-related, or psychomotor and attitude or the affective. Utilizing this tool, technology operators can specifically align their use of educational technology and innovations with learning in these basic domains.

**Keywords:** Educational innovation, Edtech, Education, Medical, ASIC framework, ASIC matrix, Adaptation, Reference standards, Integration, Compliance

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## Introduction

The roles of educational technology and innovations in medical education seem to continue to be more critical and integral; that is because it appears that many stakeholders have come to appreciate the potential benefits of technology much more than ever before. A key consideration, which is more like a fallout from the massive integration of technology and innovations, is the need to optimise their use. Understandably, certain stakeholders and regulators might not have been adequately prepared for the current level of technology use to support medical education. The same might be applicable to some academic leaders and educators as well as learners and trainees.

The ASIC Framework was developed to provide a much-needed framework to help

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educators and medical education stakeholders to adapt, standardise, and integrate the use of innovations and educational technology in the delivery of medical education (1). The use of innovations and educational technology has considerably increased on account of a number of reasons, including advancements in education, with specific emphasis on medical education (1) and the COVID-19 pandemic and its syndemic effects (2, 3).

The ASIC Framework was published as a foremost framework guiding the introduction and optimal utilisation of educational technology and innovations in the context of medical education. The question arises based on the fact that different stakeholders and institutions have designed and developed or adopted and deployed various medical education-associated technology in a way that they probably deemed the best possible and the most effective. Educational technology and innovations have become increasingly integral and important to the delivery of medical education and training (4-7). It is important to appreciate the fact that medical education is highly regulated, with emphasis on benchmarks and standard practices. This is simply to ensure that, irrespective of the training institution, medical practitioners and health workers possess the requisite skills that can make them provide people with the services required in the best possible ways. This will therefore justify the need for a framework concerning educational technology and innovations, which could be used to support the delivery of medical education. Additionally, educational technology and a high number of innovations are relatively new and heterogeneous in terms of types and the needs that they can satisfy.

Additionally, EdTech [or educational technology], might not only refer to the collection of technologies that support learning and teaching but also the paradigm and practices that address the development and use of such technology. This subject is rapidly evolving. Moreover, system factors [organisational setup, culture, and practices], as well as preferences, could make significant differences in terms of choices of what educational technology and innovations could be used. Furthermore, such attempt to extensively regiment the use of educational technology and innovations in medical education is not in line with the tech culture. On top of several other values and benefits, technology brings results in flexibility, creativity, and dynamic deployment (8, 9). What is however important is the need to provide framework[s] and standard guide[s] to ensure that, irrespective of the educational technologies and innovations that might be employed, they are used in the most effective, educationally compliant, and in evidence-based ways, following the best practices, and in accordance with the philosophy of medical education, curricula requirements, and learning objectives.

There is a methodical approach to this work. However, unlike conventional research that follows established methods or protocols, innovations and creative works often follow a well-defined, but de novo conceptual approach. In this instance, the approach involves a number of steps which constitute a series of carefully constructed phases, including: (1). identification and definition of the problem or challenge; (2). obtaining evidence to support an approach; (3). creating a framework to address the problem; (4). generating an operational model to use the framework; (5). obtaining data through the use of framework and matrix to gather evidence for advancement and to influence better future practices. This is similar to a previous approach that was used to develop the SimZones framework (10, 11). While these phases give the big picture within which context this publication is situated, the publication of the ASIC Framework operational matrix aligns with the Phase 4 (Figure 1).

## *ASIC Framework CPA Matrix: Creating an Alternative Matrix and Worksheet*

The alternative ASIC Framework, also called the ASIC-CPA matrix, considers the ASIC tenets in the contexts of the curriculum [C],

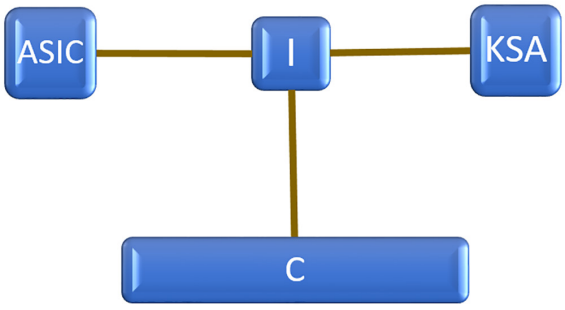


**Figure 1:** ASIC Framework. A framework for guiding medical educators and stakeholders towards adaptation, standardisation, and integration of EdTech and innovations while ensuring compliance with institutional, professional, and regulatory standards. An adaptation of the original ASIC Framework as adapted from the original publication (1).

pedagogy [P], and assessment [A]. This approach considers three basic parameters, which primarily determines how well educational technology or innovation is being deployed to deliver medical education. It is still in line with the ASIC Framework whereby the four tenets are being considered relative to the key determining factors of delivery, including curriculum, pedagogy, and assessment (Figure 2). It also has a digital interface prototype (Figure 3).

The alternative ASIC Framework operational matrix works with the same principle as the original matrix. For the sake of clarity and consistency, following part contains an excerpt from the publication on the original framework:

**Excerpt:** The use of the ASIC Framework and its guiding rules (1).

1. Optimal performance requires an average score of 2.5-3 across all ASIC aspects.

2. The minimal score of 2 is required in all ASIC aspects.

3. The score measures the potential of operationality which is achieved when the innovation or technology in question is optimally used as indicated.

4. Measurement failure, under any of the ASIC tenets/areas would mean poor operationality and performance measurements, even with a good overall score; consequently, the area of failure should be addressed until a 'pass' score is attained in the category.

5. The pass score for an ASIC tenet is 2/3 0r 0.7.

6. The overall pass score is 2/3 or ~70%, as an average score across all ASIC areas.

Arguably, much more than ever before, efforts are now made to promote the integration of simulation (12), artificial intelligence, EdTech, and telemedicine facilities into medical training. Standalone technology and applications are also being developed and deployed. Some of these include the Anatomage table, high fidelity mannequins, the google glass, the magic mirrors, and others. In addition, there are virtual patients and software, such as the Zygote and the Complete 3D software to teach anatomy, using a digital human. Individual medical educators and teams have reported their experiences, with several reporting significant successes and positive impacts on learning outcomes with the use of technology and innovations (13). We therefore have immense evidence on the benefits of technology and innovations to medical education (14).

What stakeholders in medical education now need to ensure, is that standard and best practices are adhered to. This would mean that these innovations and this technology are helping to accomplish medical education competencies as intended and defined in programmed outcomes. In addition, they should also be used to provide effective benefits in the attitude domain of learning by helping train tech-inclined, tech competent, and tech compliant future doctors, noting that the future of work is predictably tech-complaint, tech-savvy, and technophilia. The latter is used to describe a situation whereby doctors and health workers embrace and utilize technology optimally. This would be in contrast to the current scenario where in certain instances, health workers, trained under the old paradigm, might exhibit tecnophobia (a term used to refer to being, tech-averse or tech-incompetent). Technophobia is not just incongruent with the anticipated future culture of work and medical practice. Meanwhile, it could also slow down the progress that medical education and

**The ASIC Framework CPA Matrix and Prompts**

| **A- Adaptation** | **S- Standardisation** |
|---|---|
| **C-A1**. Use of technology/innovation indicated in curriculum/syllabi – *there is specified time/period/duration for use* [P]<br>[Yes__ ǀ No__]<br>**P-A2**. The use of technology or innovations are used to achieve stated learning objectives- *there is an objective statement* [P]<br>[Yes__ ǀ No__]<br>**A- A3**. Impact of technology or innovation on learning outcome is measured with formative/summative assessments - *learning outcome identified and assessed* [P]<br>[Yes__ ǀ No__]<br>[2-out of-3 or 66.6%] | **C- S1**. Time allocation on curriculum/syllabi- there is a specific *time/period allocated for use* [P]<br>[Yes__ ǀ No__]<br>**P- S2**. Method of use is pre-determined and a protocol or guide for use is prepared- *methodical guide or a protocol is available* [P]<br>[Yes__ ǀ No__]<br>**A- S3**. Alignment with specific objective that is also measured or assessed- *specific objective[s] are aligned with assessment* [P]<br>[Yes__ ǀ No__]<br>[2-out of-3 or 66.6%] |
| **I- Integration** | **C- Compliance** |
| **C-I1**. Specific competencies to achieve with technology/innovation identified in curriculum or syllabus– *Session delivery contributes to specific competencies* [P]<br>[Yes__ ǀ No__]<br>**P- I2**. The use of the technology or innovations aligns with known pedagogy or pedagogical principles- *pedagogy is defined, and lesson is planned* [P]<br>[Yes__ ǀ No__]<br>**A- I3**. Assessment of learning with innovation or technology contributes to final measure of training impacts e.g. final assessments or grades- *assessment of learning or performances with EdTech/innovation is measured.*<br>[Yes__ ǀ No__]<br>[2-out of-3 or 66.6%] | **C- C1**. The use of technology or innovation aligns clearly with identified curriculum philosophy and/or objective- *There is evidence of institutional compliance* [P]<br>[Yes__ ǀ No__]<br>**P- C2**. There is a learning theory or a pedagogical principle that supports the methods – *There is evidence of regulatory compliance* [P]<br>[Yes__ ǀ No__]<br>**A3- C3**. Assessment of technology or innovations impacts on learning aligns with institutional and/or regulatory practices. – *There is evidence of cultural compliance* [P]<br>[Yes__ ǀ No__]<br>[2-out of-3 or 66.6%] |
| **Total** | |
| **Prompts [P]:** | |
| **A- Adaptation**<br>**C- A1**: Is this technology/innovation clearly indicated as a learning tool/facility in your curriculum, or syllabus or lesson plans?<br>**P- A2**: Is the use of the technology or innovation aligned with specifically stated learning objective[s]?<br>**A- A3**: Is there an indicated assessment method that is used to measure the impact[s] of technology or innovation use on learning outcome, as measured with formative/summative assessments? | |
| **S- Standardisation**<br>**C- S1**: Is there a specific time allocation or unit allocation for the use of the technology in your curriculum or syllabus?<br>**P- S2**: Is there a planned or standardised method of using the technology or innovation. e.g. learning protocol or learner's guide?<br>**A- S3**: Is the technology or innovation as used involved in the formative or summative assessments? | |
| **I- Integration**<br>**C- I1**: Is there any specific competencies to achieve with the technology/innovation as indicated in the curriculum or syllabus?<br>**P- I3**: Is the use of the technology or innovations in alignment with known pedagogy or pedagogical principles?<br>**A- I3**. Is there an assessment of learning with innovation or technology that contributes to measures of training impacts? | |
| **C- Compliance**<br>**C-C1**: Is the use of the technology or innovation in alignment with identified institutional curriculum philosophy and/or objective?<br>**P-C2**: Is there is a learning theory, pedagogical principle or a professional practice that supports the use of the technology or innovations?<br>**A- C3**: Is the use of the technology or innovations and its impacts on learning in alignment with programme and/or regulatory requirements as measures of competences. [P] | |

**Figure 2:** ASIC Framework alterative matrix. The alternative ASIC Framework or the ASIC-CPA Matrix considers the ASIC tenets in the contexts of the Curriculum [C], Pedagogy [P], Assessment [A].

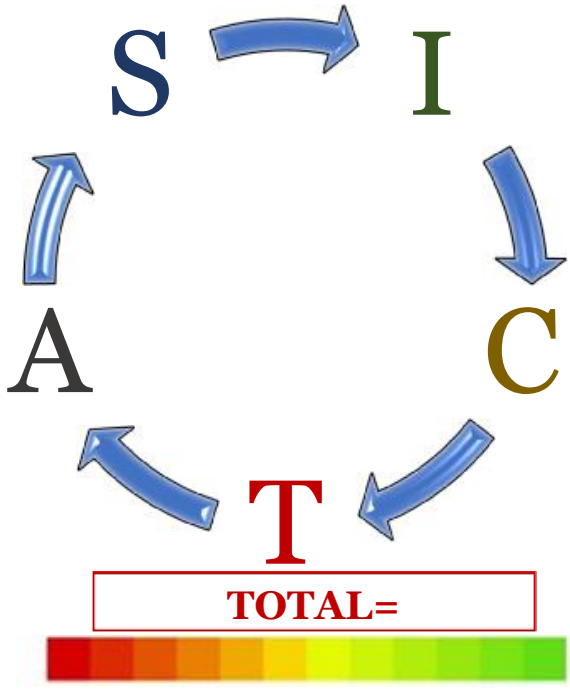


**Figure 3:** ASIC Framework Matrix result interface. A prototype of the display inter-face for the results of the use of the ASIC matrix to measure the performance of an educational technology or innovation. The alternative ASIC Framework Operational Matrix works with the same principle as the original matrix [A= Adaptation; S= Standardisation; I= Integration; C= Compliance; T= Total score].

practice could make through the contributions of technology if it is not addressed. The future will need doctors and health workers who appreciate EdTech, and can work with simulations, artificial intelligence (15-18), robot-supported practices, such as robotic surgery, development, and the use of medical algorithms, and telemedicine practices (19, 20). This is another main reason why technology and innovations should become integrated into the training programs.

The ASIC Framework is not essentially the only effort that has been made to ensure that the standards and best practices are enshrined in the tech culture of medical education; for example, Harvard University and Boston Children Hospital medical educators and trainers developed the medical simulation guide, called SimZones (10, 11), which has become quite popular. The SimZones guide was developed to guide institutions, such as medical schools and training hospitals, on the best strategy to deploy medical simulation in the training of students and medical professionals (10). The guide defines simulation into zones. It provides the attributes of each zone as well as how simulation could be performed to suit different categories of trainees based on the training requirements as well as the level of the trainee. This guide, which has been successfully used at the Harvard Medical School and Boston Children's Hospital, is one of the outstanding efforts that also buttresses the fact that there is a need to provide frameworks and guides to ensure that medical education technology and innovations are deployed in standardised, integrated, educationally valid, and compliant ways following the best practices. Medical educators need adequate resources and supportive systems in their efforts to use technology and innovations; this could add value to human capacity in medical education (21).

It is worthy of note that the ASIC Framework and its alternative matrix could be adapted to almost any type of educational technology and innovations towards ensuring the optimal use of such technology and innovations. The fact that the framework has a practical operational matrix makes its use practical as objective as possible. This framework and matrix could have a significant and positive impact on shaping the best strategy to deploy technology and innovations. In addition, it could guide designers and developers of EdTech products in their efforts to ensure that their products best meet the need of leaners, educators and training institutions.

## Conclusion

The development of the ASIC Framework operational matrix is an advancement over the original ASIC Framework. It provides a quality measure of the effectiveness of a technology or innovation. Medical educators and stakeholders can therefore employ the operational matrix to support their efforts to deploy and optimise the use of EdTech and innovations.

**Conflict of Interest:** None declared.

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