THE UNIVERSITY OF
BUCKINGHAM
FACULTY OF MEDICINE
AND HEALTH SCIENCES

Standards for Technology-enhanced and Simulation-based Learning.

School of Medicine

Faculty of Medicine and Health Sciences

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Contents

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Purpose

The purpose of this standards document is to provide comprehensive guidelines for unit and theme leads in integrating Technology-enhanced and Simulation-based Learning (TESBL) into Phase 1 of the Medical Course at Buckingham.

By using the expertise and operational guidance of the Simulation-Based Education Committee, the aim is to ensure the high quality and logical sequencing of simulation activities, foster faculty development, and align with clinical best practices. This approach is designed to enhance educational coherence, encourage innovation, and facilitate the dissemination of good practices across the University of Buckingham and Local Education Providers (LEPs). This standards document provides a framework for creating an immersive and effective learning environment that reflects the latest advancements in medical education, promoting continuous improvement and collaboration among educators and medical students. This document not only serves as a strategic framework but also acts as a dynamic guide for the continuous evolution of TESBL practices. It emphasises fostering interdisciplinary collaboration and data-driven decision-making, ensuring that innovative teaching methodologies align with both academic rigor and evolving healthcare standards.

This document establishes standards for integrating TESBL and promotes the adoption of innovative and creative approaches. These methods should undergo continuous evaluation and be shared with other unit leads to assess their impact and effectiveness. Practices demonstrating success can be expanded for broader application, while less effective strategies can be refined or discontinued, fostering a culture of continuous improvement and evidence-based decision-making.

Context

Definition of Technology-enhanced and Simulation-based learning

Technology-enhanced and Simulation-based Learning (TESBL) in medical education involves the use of a broad range of tools and approaches, platforms, and innovative methodologies designed to enhance and support the learning process through the interdisciplinary collaboration and data-driven personalisation and learning analytics . These include e-learning platforms, simulation-based education, virtual reality (VR), augmented reality (AR), mixed reality (MR), artificial intelligence (AI)-driven learning systems, haptic feedback technologies, serious gaming and gamification, telemedicine simulations, 3D modeling and printing, and learning analytics platforms. Such tools are transforming traditional medical education by providing innovative approaches to teaching, learning, and assessing clinical competencies.

Strategic Significance of of Technology-enhanced and simulation-based learning

Traditional medical education relies on lectures, textbooks, direct training, and placements. However, interactive, technology-driven strategies are now supplementing or replacing these methods to improve learning experiences.

TESBL offers innovative methods to engage students through interactive experiences that closely mimic real-life medical scenarios. These approaches allow students to develop practical skills, critical thinking, and decision-making abilities in a controlled and safe environment. By providing a hands-on, immersive learning experience, TESBL prepares students to face real-world challenges with confidence and competence.

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Incorporating TESBL into medical education also promotes lifelong learning and adaptability, as students become familiar with technologies and methodologies that are constantly evolving. This alignment with the latest advancements ensures that medical education remains relevant and effective in preparing future healthcare professionals.

TESBL serves as more than just a tool for skill acquisition; it plays a pivotal role in advancing patient safety, fostering interdisciplinary collaboration, and driving innovation in healthcare education. By creating opportunities for team-based learning, TESBL enables students from various healthcare disciplines to work collaboratively in realistic clinical scenarios, strengthening communication and teamwork core competencies essential in modern medical practice. It also promotes lifelong learning and adaptability, equipping students with the ability to navigate an ever-evolving medical landscape and engage with emerging technologies and evidence-based practices. Crucially, TESBL enhances patient safety by allowing learners to refine their skills in a controlled environment, thereby minimising the risk of errors when transitioning to real clinical settings. This approach ensures that future healthcare professionals are not only technically proficient but also adaptable, reflective, and prepared to meet the complex demands of contemporary healthcare.

Standards Details

These standards aims to establish a comprehensive, adaptable, and future-oriented framework for TESBL. It focuses on integrating cutting-edge technologies, dynamic assessment methods, and personalised learning strategies to foster engaging, practical, and data-informed educational experiences. The goal is to create learning environments that not only support individual growth but also encourage collaboration, critical thinking, and adaptability key skills for modern healthcare professionals.

To ensure TESBL remains effective, inclusive, and scalable, the outlined features require continuous evaluation and refinement. Incorporating evolving best practices and leveraging advancements in educational technology will strengthen the policy's impact, ensuring it remains aligned with the evolving demands of healthcare education.

Key features of Technology Enhanced and Simulation-based Learning.

A variety of features should be encompassed to enhance the educational experience in TESBL:

- Personalise learning by implementing adaptive algorithms to tailor educational content to each learner's progress, predict learner challenges, enabling proactive interventions. and comprehension, ensuring a customised learning experience that caters to individual needs.
- Ensure availability by facilitating access to educational materials anytime and anywhere and support self-paced learning to accommodate diverse schedules and learning styles by apply Universal Design for Learning (UDL) frameworks and include offline access options to support equity and inclusivity.
- Integrate tools such as simulations, virtual reality (VR), and augmented reality (AR) Mixed Reality (MR) or AI generated Haptic Feedback Systems to create engaging, firsthand experiences that mimic real-life scenarios to enhance student engagement.
- Use innovative assessment methods by providing computer-based testing, Simulation-Based Assessments (e.g., Objective Structured Clinical Examinations [OSCEs] using VR), peer assessment tools to evaluate teamwork and communication. and automated feedback systems, and offer immediate, personalised feedback to help students identify areas for improvement and refine their skills.

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- Ensure scalability by developing simulation solutions such as cloud-based simulation platforms and open-source software to optimise scalability without increasing costs. that can support a large number of learners without increasing resource demands, ensuring education remains accessible and cost-effective as the number of users grows.
- Incorporate features in e-learning platforms that enable inter-professional education (IPE), promoting collaboration among medical, nursing, and allied health students.
- Regularly update digital content by Implement continuous quality improvement (CQI) cycles and student feedback systems to ensure content stays current and learner-focused to reflect the latest advancements in the field, ensuring students receive current and relevant information.
- Implement analytics tools to track student performance and engagement, using employing the AI-powered dashboards that highlight at-risk students and recommend personalised learning pathways.

Curriculum integration and quality assurance

 The integration of TESBL into the medical curriculum must be strategic, structured, and aligned with competency-based education principles to foster comprehensive learning experiences. TESBL should not only complement theoretical knowledge but also serve as a cornerstone in the development of clinical skills, critical thinking, teamwork, and professional competencies. By embedding TESBL within the curriculum, students gain practical, hands-on experience in a controlled environment that mirrors real-world scenarios, preparing them for the complexities of modern healthcare.

A robust quality assurance framework is essential to maintain the integrity, relevance, and effectiveness of TESBL. Continuous evaluation, informed by data analytics and multi-source feedback, ensures that simulation-based activities evolve in response to educational needs, technological advancements, and student feedback. Effective resource management, combined with sustainable and scalable strategies, guarantees equitable access to TESBL opportunities, regardless of cohort size or institutional resources.

Curriculum Alignment with Competency-Based Education (CBE)

TESBL activities must be intentionally mapped to the core competencies outlined in the UOB medical curriculum. Each simulation should be designed with specific learning outcomes in mind, ensuring it contributes to the development of both technical and non-technical skills. This approach fosters a cohesive learning experience where theory and practice are seamlessly integrated.

- Link each TESBL activity to defined learning objectives and competencies.

- Ensure TESBL complements both foundational science and clinical training components.
- Use case-based simulations to strengthen clinical reasoning and decision-making skills.

Progressive and Adaptive Learning Pathways

TESBL activities should follow a logical progression from simple to complex scenarios, enabling students to build skills incrementally. By incorporating adaptive learning strategies, the

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curriculum can cater to individual student needs, allowing learners to progress at their own pace while meeting core competencies.

- Design learning pathways that adapt based on student performance and analytics.

- Use data-driven insights to offer tailored remediation or enrichment opportunities.
- Implement virtual simulations for flexible, self-paced skill development.

Quality Assurance and Continuous Improvement

Maintaining high standards in TESBL requires structured evaluation mechanisms that integrate continuous quality improvement (CQI) processes. Feedback from students, faculty, and peer reviewers should inform ongoing curriculum enhancements, ensuring that TESBL remains current, relevant, and aligned with evolving educational standards.

- Establish multi-source feedback systems involving students, peers, and faculty.
- Conduct regular audits and CQI cycles to evaluate TESBL activities.
- Align quality assurance processes with national and international accreditation standards.

Resource Optimisation and Scalability

Effective TESBL integration depends on the efficient coordination of facilities, equipment, and human resources. To support scalability and sustainability, institutions should leverage cost-effective solutions, such as cloud-based platforms and virtual simulations, while maintaining the integrity of hands-on learning experiences.

- Utilise shared resource models to maximise access to simulation facilities.

- Integrate virtual simulations to reduce physical space and equipment demands.
- Conduct cost-benefit analyses to ensure the financial sustainability of TESBL programs.

Integration into Assessment Frameworks

TESBL should be embedded into both formative and summative assessments to evaluate student competencies in a comprehensive manner. This integration should be undertaken following robust piloting and familiarisation to ensure that TESBL assessment tools and methodologies are effective and align with educational objectives. Simulation-based assessments offer valuable insights into students' clinical reasoning, procedural skills, teamwork, and professionalism.

- Incorporate TESBL into Objective Structured Clinical Examinations (OSCEs) and workplace-based assessments (WBAs).

- Use simulation scenarios to assess complex, interdisciplinary skills such as communication, leadership, and ethical decision-making.
- Implement immediate, data-driven feedback mechanisms post-assessment to guide student development.

Interdisciplinary and Team-Based Learning

Modern healthcare demands collaboration across disciplines. TESBL should foster inter-professional education (IPE) by designing simulation scenarios that bring together students from

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medicine, nursing, pharmacy, and allied health professions, promoting teamwork and collaborative problem-solving.

- Develop interdisciplinary simulation scenarios reflecting real-world healthcare environments.
- Encourage role-based learning within teams to strengthen communication and leadership skills.
- Use debriefing sessions to reflect on team dynamics and collaborative decision-making.

Fostering Faculty Development and Continuous Improvement

An effective TESBL program hinges on the continuous growth and expertise of its educators. Faculty members play a central role in shaping student experiences, and their ability to adapt to evolving technologies and educational strategies is crucial for maintaining high-quality medical education. To ensure faculty are well-equipped to deliver impactful TESBL experiences, it is essential to implement structured development programs that emphasise continuous learning, mentorship, and evidence-based practices.

Continuous Professional Development (CPD)

Faculty members should have access to ongoing training programs that focus on emerging technologies, simulation methodologies, and evolving educational practices. CPD programs should go beyond basic skills training, incorporating topics such as adaptive learning strategies, data-driven teaching approaches, and advanced simulation design. By fostering a culture of lifelong learning among educators, institutions can ensure that faculty remain agile, innovative, and responsive to changes in medical education.

- Introduce structured CPD workshops focusing on VR/AR integration, AI-driven education tools, simulation case scenarios development and simulation pedagogy.
- Encourage faculty participation in certified simulation-based education programs to ensure global best practices are followed.
- Incorporate reflective teaching practices and evidence-based education strategies into training modules.

Mentorship, Coaching, and Peer Learning

Establishing robust mentorship and coaching programs is vital for faculty development. Experienced educators can guide junior faculty through the complexities of TESBL, offering insights into best practices, curriculum integration, and assessment strategies. Additionally, peer learning groups can create spaces for educators to collaborate, exchange ideas, and co-develop new teaching approaches.

- Implement faculty mentoring schemes focused on simulation design, debriefing techniques, and curriculum integration.
- Encourage peer observation programs to foster reflective practices and collaborative problem-solving.
- Create faculty learning communities that focus on innovation in TESBL, promoting a culture of continuous improvement.

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Access to Resources and Research

Faculty development is strengthened when educators have access to **current research, educational tools, and advanced simulation technologies**. Ensuring that faculty can stay informed about the latest developments in medical education not only enriches the learning experience for students but also fosters a scholarly approach to teaching.

- Provide access to medical education journals, simulation research databases, and educational technology repositories.

- Offer opportunities for faculty to participate in academic conferences, workshops, and research collaborations in the field of TESBL.
- Establish a centralised resource hub for teaching materials, case studies, and simulation scenarios.

Performance Evaluation and Feedback

A structured framework for evaluating faculty performance ensures that educators continually refine their teaching methods. Regular evaluations should focus not only on student feedback but also on peer reviews and self-assessments. Constructive feedback helps educators identify strengths and areas for growth, fostering a mindset of continuous improvement.

- Implement multi-source feedback systems that include student evaluations, peer reviews, and self-reflection tools.
- Use teaching portfolios as a means for faculty to document their development, reflect on their practices, and set future goals.
- Schedule annual performance reviews that integrate qualitative and quantitative data to provide holistic feedback.

Promoting Innovation and Collaboration

Creating an environment that encourages innovation and collaboration among faculty can lead to the development of cutting-edge TESBL approaches. By fostering cross-disciplinary projects, faculty can explore new teaching methods, integrate diverse perspectives, and co-create impactful learning experiences.

- Facilitate interdisciplinary faculty workshops to encourage collaborative curriculum design.
- Establish innovation grants or funding opportunities to support faculty-led research and pilot projects in TESBL.
- Encourage participation in cross-institutional networks to share best practices and expand access to new ideas.

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Staying informed about trends and evidence-based advancements in simulation.

It is crucial to ensure that medical education remains dynamic, relevant, and aligned with the evolving needs of healthcare. Continuous updates allow educators to integrate the latest best practices, cutting-edge technologies, and innovative teaching methods, ultimately enhancing learner engagement and clinical competence. Moreover, staying up to date helps institutions maintain high educational standards, improve patient safety outcomes, and ensure that future healthcare professionals are equipped to navigate modern clinical challenges effectively. Ensure that medical education remains current and effective by staying informed about trends and evidence-based advancements in simulation technologies and methodologies.

- Regularly review the latest research and advancements in simulation technologies and methodologies to stay informed about evidence-based best practices.
- Encourage attendance at conferences, workshops, and seminars to learn about new simulation technologies and teaching methods.
- Foster a culture of innovation and experimentation where educators and students explore latest ideas and experiment with novel teaching methods.
- Promote collaboration among educators to share insights and best practices related to TESBL.
- Integrate the latest advancements in TESBL into the curriculum to reflect current best practices and ensure that TESBL activities align with educational goals and enhance the overall learning experience.
- Implement regular evaluations of TESBL activities to gather feedback from educators and students to refine methods.

Encouraging innovation within undergraduate medical education

It is essential for fostering a dynamic learning environment that adapts to the evolving demands of healthcare. By promoting creativity and the integration of new ideas, medical education can move beyond traditional teaching methods to incorporate cutting-edge technologies, interdisciplinary approaches, and evidence-based practices. This not only enhances student engagement and critical thinking but also prepares future healthcare professionals to navigate complex clinical settings with adaptability and problem-solving skills. Cultivating a culture of innovation ensures that medical education remains relevant, forward-thinking, and aligned with the continuous advancements in medical science and patient care.

- Foster a culture of innovation by encouraging open-mindedness and a willingness to experiment with new teaching methods and technologies.
- Promote research in educational methodologies and technologies and integrate findings into the curriculum.
- Facilitate networking and collaboration among faculty, students, and external partners to share innovative ideas and practices.
- Implement pilot programs to evaluate novel approaches and gather feedback before wider adoption.
- Actively involve students in the development and evaluation of new educational practices.
- Allocate resources, including funding and time, to support innovation and experimentation

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within the curriculum.

General Standards for Integrating Technology Enhanced and Simulation-based Learning.

To effectively incorporate advanced technologies in medical education, it is crucial to adhere to the following general standards:

- Ensure that all technological tools and platforms are user-friendly, interactive, and accessible to both students and educators.
- Provide necessary training for both students and educators to enhance their proficiency with digital tools.
- Establish support systems to assist students and educators who may face challenges in adapting to innovative technologies.
- Promote the development of self-discipline and motivation among students to effectively engage with technological platforms.
- Secure adequate funding and invest in the necessary infrastructure to support the effective integration of technologies in medical education.
- Ensure the availability of skilled educators and technical support to facilitate the use of advanced technologies.
- Use technologies to enhance clinical skills, knowledge retention, and learner confidence.
- Provide hands-on, controlled environments for practice, helping learners refine techniques and retain critical information.
- Continuously improve and carefully integrate innovative technologies with existing training methods.
- Involve end users in the development and refinement of technological tools to ensure their effectiveness and relevance.
- Recognise that technological tools are not replacements for essential clinical experiences and traditional training methods.
- Integrate technologies as complementary tools to enhance and support real-world clinical practice.
- Ensure data privacy, security, and ethical use of all TESBL platforms, protecting sensitive information and adhering to regulatory standards.
- Implement evidence-based evaluations to regularly assess the effectiveness of technology on learning outcomes and clinical skill development.
- Promote interdisciplinary collaboration by using TESBL to facilitate team-based learning among medical, nursing, and allied health students.

Specific Technologies

E-Learning Platforms

- Implement open-source learning management systems (LMSs) such as Moodle and 360Learning.
- Enable educators to design and administer online curricula, manage course content, monitor student progress, and provide feedback.
- Allow students to access materials and engage with content at their own pace and schedules.
- Promote the benefits of e-learning platforms, including the extensive resources and

interactive content they offer.

Simulation-Based Education for Clinical Skills Training

- Use high-fidelity simulations, including task trainers, manikins, standardised patients, and computer-based simulations.

Augmented Reality (AR) Mixed Reality (MR) and Virtual Reality (VR)

- Use AR to enhance real-world environments by overlaying digital information, particularly in teaching anatomy and surgery.
- Implement screen-based and immersive VR solutions to enhance spatial understanding, teamwork, and non-technical skills (e.g., decision-making, communication).

Artificial Intelligence (AI) in Medical Education

- Implement AI-driven learning systems for personalised testing and tailored learning experiences.
- Develop intelligent tutoring systems that provide real-time feedback and guidance to enhance the learning experience.
- Reform undergraduate medical education curricula to prepare students for an AI-shaped healthcare environment.

Responsibilities

It is the responsibility of the Phase 1 and Phase 2 leads to update these standards in collaboration with the Lead/Director of Medical Education and the Technology-Enhanced Learning (TEL) Committee, to ensure regular updates to these standards. They must review technological advancements, align TESBL practices with current educational frameworks, and oversee compliance with institutional goals. Regular faculty feedback and student evaluations should also guide updates to maintain relevance and effectiveness.

Related Policies

1. Standards for Group Work in Phase 1
2. Clinical Skills Simulation Guidelines
3. e-Learning and Virtual Learning Environment (VLE) Policy
4. Assessment Policy for Simulation-Based Learning
5. Faculty Development and Training Guidelines for TESBL

Document Control

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Benchmarking and Alignment with Leading UK Medical Schools : These standards for Technology-Enhanced and Simulation-Based Learning are informed by benchmarking against leading practices from top UK medical schools, including the University of Dundee, University of Oxford, University of Cambridge, and University College London (UCL), ensuring alignment with established excellence in medical education.