Opinion

The Roles for Information Communication Technology, Web-2.0 and Internet of Things in Curricular Delivery and Assessment in 21st Century

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Dedicated to Rabindranath Tagore, whose timeless quote says,

"Don't limit your child to your own learning, for was born in another time."

"*What electric motor has done to enhance human muscle power in 20th Century, the "Chip" will do for human brain power in 21st Century. Let us welcome it.*" (KRS, Doctors' Computer Forum, 1987, cited in NTTC Bulletin, 2000).[1] My belief for the last three decades is a reality today. Let us try to harness the power of the ubiquitous 'smart chip' to enhance the curricular delivery and assessment of health professions education.[2]

SOME BASIC DEFINITIONS

Health informatics (also called medical/nursing/biomedical informatics) is a trans-disciplinary science combining information-communication-technology and health care.[3] It deals with the infrastructure, devices, and processes required for optimal acquisition, storage, retrieval, and effective use of biomedical and health information.

E-Health refers to healthcare practices supported by electronic processes and communication; currently, it is used as an umbrella term that includes tele-health, tele-medicine, electronic medical records, mobile-health, remote patient monitoring etc.

Telemedicine is a process wherein medical information is transferred through interactive audiovisual media for clinical consultations, and for performing remote medical procedures or examinations. While Telemedicine refers to remote clinical services, Tele-health is a much broader term that includes non-clinical services like medical education, administration and research.

M-Health refers to the use of mobile devices in collecting patient level health data in real-time and conveying healthcare information to physicians, researchers, patients and patients' relatives. M-health permits direct provision of patient-centred healthcare via mobile technology.

Remote monitoring enables physicians to monitor patients remotely using various "smart" devices, also known as "Internet of Medical Things" (IoMT). These are primarily used for monitoring and managing chronic conditions like heart disease, diabetes mellitus, asthma, dementia etc. Such tele-health services provide comparable health outcomes to traditional doctor-patient encounters at lesser cost with greater patient satisfaction.

Virtual reality (VR) refers to computer-generated environments that can simulate places in the real world (simulation), as well as in imaginary world (simulacrum). Users interact with and navigate within the computer-generated environment. VR in medicine has already been successfully applied in the following areas: Surgical training and planning; Medical education; Radiation treatment planning & control; Neurological evaluation; Rehabilitation and Disability solutions; Mental health (a good example is the use of VR to treat various phobias).

The Internet of Things (IoT) refers to 'smart' devices and sensors, which can communicate directly with other smart devices using internet technology.[4] Data transmitted among these devices are processed and acted upon, resulting in changes to other connected devices, often without human intervention. An example: a smart ECG sensor detects dangerous abnormal heart rhythm and informs the other device that offers a life-saving solution (medication/electric-shock etc) for acting upon the information.

Similarly, connected teaching spaces can create "Smart Universities without walls", where VR and AR solutions offer immersive learning experiences on demand (Hyper-Situated Learning options).

Uses of IoT in education and assessment[5]

- Personalised learning: connected equipments adapt automatically to learning preferences (e.g. study efficiently)
- On demand (24x7) Learning: e-learning to interact with and within e-spaces; 'Classroom without walls.'
- New Learning Experiences: VR and AR create virtual interactions between objects and permit us to draw upon several hyperlinked data sources and types.
- The teacher's roles shift from provider of knowledge to that of a mentor and a guide for the self-directed learners.
- Continuous, and comprehensive assessment of learning outcomes through IoT, to document the progression of every medical student in achieving all the intended learning outcomes (Core curricular outcomes that define "must know – must do – must feel" competencies)

An example of e-portfolio based competency oriented training[6]

At Sri Balaji Vidyapeeth, the faculty of Medicine has initiated "Competency Based Assessment of Learning and Training (CoBALT (c))" for all the postgraduates from June 2016. All postgraduate learning experiences are monitored through individual interactive e-portfolios; their individual progress in core areas is assessed as milestones achieved on various 'entrustable professional activities (EPA)', which has been listed for each postgraduate specialty. The process aligns with ACGME and CanMed initiatives and initial experience is quite encouraging.

Looking the future

- Smart phones, tablets, cloud-computing and IoT will become the norm by 2020. With pervasive web-connected smart devices, e-Health sector would expand and find its appropriate place in rational healthcare as evidence accumulates of its areas of usefulness and value. As our society becomes a 'digital community', e-Health seamlessly integrates with it ("uberisation of healthcare").
- We face a huge disruptive potential as IoT is, i) changing how humans connect and interact with the smart devices, ii) altering our working and living environment. iii) causing a major shift from all-purpose devices, to single purpose inter-connected smart devices with integration software. It is predicted that globally we will have >2600 crores of connected devices by 2020. Massive penetration expected in India by 2025.
- Disruptive technologies could create tensions between the need to innovate for patient centered service and the need to retain professional control over quality and governance of e-health. Hype around m-Health for developing nations could obscure digital-divide and the great disparities in health status and access to healthcare.

To conclude, two questions to the honourable Vice-chancellors and deans for introspection

Is it not time that higher education moved from memory based assessment to a more authentic model for 21st Century based on continuous and comprehensive assessment of student progression and on the students' ability to solve problems using available evidence-based algorithms?

When and how would India make the quantum leap in health professions education?

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Clemastine fumarate as a remyelinating therapy for multiple sclerosis (ReBUILD): a randomised, controlled, double-blind, crossover trial

Multiple sclerosis is a degenerative inflammatory disease of the CNS characterised by immune-mediated destruction of myelin and progressive neuroaxonal loss. Myelin in the CNS is a specialised extension of the oligodendrocyte plasma membrane and clemastine fumarate can stimulate differentiation of oligodendrocyte precursor cells in vitro, in animal models, and in human cells. We aimed to analyse the efficacy and safety of clemastine fumarate as a treatment for patients with multiple sclerosis.

Methods: We did this single-centre, 150-day, double-blind, randomised, placebo-controlled, crossover trial (ReBUILD) in patients with relapsing multiple sclerosis with chronic demyelinating optic neuropathy on stable immunomodulatory therapy. Patients who fulfilled international panel criteria for diagnosis with disease duration of less than 15 years were eligible. Patients were randomly assigned (1:1) via block randomisation using a random number generator to receive either clemastine fumarate (5•36 mg orally twice daily) for 90 days followed by placebo for 60 days (group 1), or placebo for 90 days followed by clemastine fumarate (5•36 mg orally twice daily) for 60 days (group 2). The primary outcome was shortening of P100 latency delay on full-field, pattern-reversal, visual-evoked potentials. We analysed by intention to treat.

Findings: Between Jan 1, 2014, and April 11, 2015, we randomly assigned 50 patients to group 1 (n=25) or group 2 (n=25). All patients completed the study. The primary efficacy endpoint was met with clemastine fumarate treatment, which reduced the latency delay by 1•7 ms/eye (95% CI 0•5–2•9; p=0•0048) when analysing the trial as a crossover. Clemastine fumarate treatment was associated with fatigue, but no serious adverse events were reported.

Interpretation: To our knowledge, this is the first randomised controlled trial to document efficacy of a remyelinating drug for the treatment of chronic demyelinating injury in multiple sclerosis. Our findings suggest that myelin repair can be achieved even following prolonged damage.

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