SMS: Students, Mobile and Support: Four case studies using SMS to support the undergraduate medical student experience.

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Abstract

This paper will describe four case studies, using SMS messaging to support the student experience in undergraduate medical education. In three of these cases, we have integrated the ConnectTxt SMS texting service with the virtual learning environment used in undergraduate medical teaching, called EEMEC.

Firstly, it will describe the initial pilot integration which began with a research project run by the Centre for Medical Education to determine the educational value of the CUSUM chart as a workplace-based assessment tool.

Secondly and based largely on the results of the first research project, it will describe how the integration was extended by developing a mobile-enabled log book so that medical students in the clinical years of study could more easily maintain and manage their own procedural skill acquisition.
Thirdly, the paper will describe briefly how patient volunteers to assist in the assessment of medical student competence through the OSCE (Objective Structured Clinical Examination) are now largely undertaken using the SMS service.

Finally, it will highlight a project, still in progress, to integrate both the use of SMS and of mobile-enabled web voting as an alternative method of collecting whole class assessment and feedback.

**Case Study One: Research project to evaluate the efficacy of CUSUM charts as an effective workplace-based assessment tool.**

In 2010, Dr Sam Smith, a Medical Fellow with the Centre for Medical Education at the University of Edinburgh, ran a research project to determine the educational value of using cumulative sum (CUSUM) charts as a workplace-based assessment tool (Smith, 2012)

![Student Cusum Chart](image)

**Figure 1.** Student Cusum chart

In the UK, all post-graduate trainees in the field of medicine undertake annual review and assessment of competence. Different workplace-based assessment methods are used such as mini-CEX, Objective Structured Assessment of Technical Skills (OSATS) and case-based discussions (CbDs). A doctor needs to demonstrate not just competency but also provide documentary evidence regarding attainment and
continuation of this competency (Z. Setna et al, 2010). The requirement to demonstrate and document competence begins at an undergraduate level and graduating medical students are required to be competent in a wide range of diagnostic and therapeutic clinical skills by the time they graduate.

One possible method of self-assessing one's clinical skill competence is using a Cumulative Sum Chart (CUSUM chart). Originally designed to monitor the quality of manufacture products, it has been adopted by a number of different medical specialties including anaesthesia, cardiac surgery, gynaecology and midwifery to monitor learning. To the author's knowledge, there were no previous studies assessing the value of the CUSUM chart as a formative assessment tool (Smith, 2011).

A CUSUM or cumulative sum chart tracks sequential changes and are effective when a binary outcome is expected e.g. managed to do/failed to do. For the purposes of this study, the binary outcome being evaluated is clinical skill competence. Upper and lower control thresholds can be set for the CUSUM chart (see Figure 1). For the purposes of this study, the thresholds were set to determine the binary positions of a) desired performance competence and b) the point at which further assistance and guidance is required and should be sought.

The hypothesis being tested was whether the CUSUM chart, as a method of visualizing longitudinal performance in a clinical skill, would lead to improved competence in that skill.

The procedural skill used as the focus of this study was peripheral venous cannulation, which is the insertion of a small, flexible tube (the cannula) into a peripheral vein for the purpose of administering fluids and medication. 82 undergraduate medical students were recruited for the study with 41 students allocated to the intervention group and encouraged to log their cannulation attempts over a seven-month period.

Medical students in Edinburgh will typically undertake 28 weeks of placements in Year 3 and up to 43 weeks of placement in Year 5. Rotating through each medical specialty is a key component in preparing Medical students for real-life practice. It offers the opportunity for learning and assessment of competence which cannot be replicated as effectively in simulations or classrooms settings (Billet, 2001) (Pachler et al, 2011).

Each cannulation attempt was to be recorded for the duration of this study indicating the success or failure of the attempt and the level of supervision they had. We decided to use this study as a pilot for integrating the University's text service, ConnectTxt, with the undergraduate virtual learning environment used for Edinburgh medical students, EEMEC. Prior research highlighted case studies of use of SMS for administrative and notification purposes but examples of higher education institutions using SMS in a teaching and learning context are not, as yet, well evidenced (Parslow, 2006). The exploration of mobile devices for learning and competence
development in work contexts must be seen as an emerging, and still rather immature area of professional development (Pachler et al, 2011).

Intervention students were asked to record their cannulation attempts via SMS using the following sample notation i.e. "IVA Yes" or "IVA N Sup"

**Table 1. SMS notation explained**

<table>
<thead>
<tr>
<th>IVA</th>
<th>Yes or No</th>
<th>Sup (or blank)</th>
</tr>
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<tbody>
<tr>
<td>The key word required by ConnectTxt to filter the incoming texts.</td>
<td>Was this cannulation attempt successful or not. Students could text Y or N as well</td>
<td>What this a supervised attempt or not (blank if unsupervised).</td>
</tr>
</tbody>
</table>

The data recorded by each intervention student were automatically recorded to their personal log within the undergraduate VLE, EEMEC and displayed as a CUSUM chart. This was made possible by the interface built between the ConnectTxt service and EEMEC by the development team within the College of Medicine (LTS).

Detailed analysis of this data was undertaken as part of the original research and in summary the study showed that, despite the relatively small sample size, intervention students performed better in a test of cannulation skill than control students, to a statistically significant level of 5% (Smith, 2012).

**Case Study Two: The SMS-supported clinical skills log book**

In 2008, a GMC commission research paper (GMC 2008) concluded that an undergraduate’s preparedness to begin the Foundation Programme is improved by increased experiential learning in clinical practice as part of their undergraduate programme.

Equally, Tomorrows Doctors guidance for UK Medical Schools (GMC, 2009) requires graduates to ‘reflect, learn and teach others’. They should seek to acquire and integrate new knowledge and by doing so, establish the foundations for lifelong learning and continued professional development.

Undergraduates and graduates alike are required to continually and systematically reflect on practice whenever necessary and many professional organisation and
accreditation bodies, including the General Medical Council, have explicitly called for the inclusion of reflection at all levels of medical education (Aronson, 2011).

Tomorrow’s Doctors (GMC 2009) also states that graduates must demonstrate competence in 36 clinical procedures – diagnostic, therapeutic and general – at the time of graduation. Cannulation is just one of these clinical procedures.

Building upon the positive outcome of the cannulation study, an SMS-supported Log Book was established in order to enable students to maintain more easily and effectively their acquisition of clinical skills experience.

Students in years 3 to 5 of the MBChB programme spend a large proportion of their time on peripheral attachments throughout Edinburgh, the Lothians and other surrounding regions. Offering them the facility to maintain their log entries via mobile received a positive response from participating students on the cannulation study (68%) and could help to overcome logistical issues students face when trying to maintain these records whilst physically located at a distance from home and campus.

The log book was established as a pilot study for the 2011/12 academic year and so far nearly 1,300 log entries have been made since the beginning of the pilot. The highest number by any student is over 100 and the average is 9. From the beginning of the 2012/13 academic year, use of the log book will be widely encouraged throughout the MBChB programme.

Although a more in-depth study of log book use is planned in the coming academic year, initial indications are that students used the log book most effectively when the procedural skill they were attempting yielded surprising and/or unexpected results, supporting Schon’s assertion that reflection-in-action hinges on the experience of surprise.

Example student entries to support this:

On performing four venepuntures: “They were all successful, but the only down side is there were blood dropping after taking the needle out. This is mostly likely due to not taking the tunicle off before removing the needle from the vein.”

“I attempted to take blood from a patient while on a GP house call. The patient had very mobile veins, and so while I was told my technique was good, I was unsuccessful.”

“On the obstetric ward I took a blood sample from a woman in order to find out her blood group. I was instructed to label this at the bedside with the patient and by hand rather than using labels to avoid any mix-up with samples which could prove very dangerous.”
"High risk infection bloods also taken. Realignment of needle and alignment for success further learned and practised. Recognition of limits on difficult-access patient but watched as procedure successfully taken following appraisal of both hands/arms and feet."

In each of these examples, students used the log book to note down contextual factors that impacted on their undertaking of task and its outcome.

Students also used the log book well when learning points arose from attempting the skill which they noted down for personal future reference.

"Yesterday - took 5 or 6 successful bloods with one failed attempt on a lady with very small veins who had been fasting. Points to note - think its easier to hold needle in right hand and then swap bottles with left but not entirely sure. Need to look at order of draw."

"Late shift on A&E last night - lady with difficult veins as could feel them but then unable to get blood from then. FY2 managed after a couple of attempts. Learning point - take own tourniquet into A&E so don’t have to use a glove."

"Successful bloods taken from 6-8 patients in the respiratory ward. Understanding of axilla node clearance as contraindication and use of hand and how to choose vein appropriately for best result. Ensure vein held/secured firmly for best result and choose vein wisely to minimise patient discomfort. Long-term steroids can also make vein difficult to find. Effective high-risk precautions also observed. Making a fist for veins on hand can also increase ease of access. Palpation can also help with location of veins if not easily observed”

This use of the log book supports Schon’s assertion that reflection-on-action, taking place after the action occurs, can influence future actions. In each of these examples, students have noted something about the procedure that anticipates a change in the way they might perform it in future.

It should be noted also that in the majority of log entries, where the procedure was successful and the results unsurprising and as anticipated, minimal additional information was recorded beyond perhaps the date and location.

**Case Study Three: Patient recruitment for OSCEs**
Increasingly, the use of real patients in medical education is seen to be of great benefit to students as patients are recognized as ‘experts’ in their own medical conditions and may help to enhance student experiences of real-world medicine (Jha et al, 2008). Students rate their experience of using real patients significantly higher than simulated patients for ‘amount of learning’ as well as for many of the essential communication skills (Clever et al, 2011).

In Edinburgh, volunteer patients are regularly recruited for the Student OSCEs (Objective Structured Clinical Examination). Prior to September 2011, paper poster advertisements were pinned to hospital notice boards with tear off strip contact numbers for interested volunteers to take away. This was replaced, in September 2011, with over 500 laminated posters and flyers (Figure 3) posted across hospitals, clinics and GP surgeries in Edinburgh and the Lothians. Patients wishing to participate in the assessment of future doctors text the word ‘Patient’ to the ConnectTxt number as provided on the posters. The OSCE organisers then have the contact number for the volunteer and can follow up with a return call.

The administrators of this process see this as a much more efficient method of patient recruitment, the posters do not need to be replaced over time and they are happy that this method is leading to good patient recruitment numbers for Edinburgh.

Figure 2. Patient Recruitment Poster

Case Study Four: Classroom-based assessment and feedback tool
In-class electronic voting systems are widely regarded as an effective method of increasing student-engagement in lectures. They can help turn the traditional model of lecture delivery from that of straightforward information transfer into a more student-centred, discussion-based and interactive mode of delivery (Mazur, 2009).

In-class electronic voting systems (EVS) have been implemented across a wide range of disciplines to enhance the student learning experience (McClearn et al, 2010) and are widely acknowledged to ‘support increased motivation and attainment’ and also to provide ‘rapid feedback on the learning process’ to students (Simpson, 2006).

However, despite broad recognition of its merits, very few members of the teaching staff within the College of Medicine use EVS regularly in their teaching. The general feeling among staff is that this is due to two main factors. Firstly, the time it takes to adapt existing teaching materials and teaching styles to include this interactivity i.e. downloading the right software, restructuring slides, ensuring that the technology is not just being used for the sake of it but has legitimate educational value. Secondly, the technical implications and ‘the hassle’ of using an EVS in a specified lecture i.e. testing the batteries, issuing and collecting in the handsets, searching for and replacing the missing handsets. Two additional support people were normally required for an event using EVS.

We wanted to explore possible ways of overcoming these two key barriers. To find a method that would be simple and straightforward for staff to use and offer a more flexible and spontaneous method of requesting in-class responses and feedback.

In a recent survey, undertaken with undergraduate medical students participating in the cannulation research study (see Case Study 1 in this paper), 87% of students have contract mobile phones (13% pay-as-you-go) and 40% of students have smart phones. These figures were consistent with a wider survey of undergraduates across all schools at the University of Edinburgh during the same time period. This wider survey also indicated that 85% of students also own laptops.

We wanted to make sure that any solution we devised would be as inclusive of all students as possible and would not be dependent on student ownership of one item of technology over another. We were also aware that there was still an on-going question regarding ‘who’ should provide the technology used in teaching and learning – the student or the institution (Sheach, 2011).

We also wanted staff to be able to run an in-class voting exercise independently of any presentation software so that it could be used more flexibly and for ad hoc and spontaneous voting events. We also wanted to make sure that the set up and support requirements to run such an event were kept to a minimum.

With this in mind, we devised a system that would allow students to participate in an in-class voting event in one of three ways.

Firstly, we set up a ConnectTxt key word VOTE for those students who were happy to use their mobile and text allowance for this purpose. We also created a mobile-enabled web page with voting buttons that would be our ‘cost-free’ alternative that could be used from any WIFI-enabled device e.g. mobile phone or laptop.
This was a proof-of-concept project that we have been able to extend so that results can be presented in one of two different formats; pie chart (Figure 3) or bar chart, depending on preference.

There are, however, a large number of competing products on the market at the moment that can provide ‘hybrid’ voting alternatives and given the high institutional investment in the EVS technology, no decision has been taken about what direction we will take this in in the near future.

**Conclusion**

This paper has highlight four ways in which we have been using SMS to support undergraduate teaching and learning within the College of Medicine.

We have some further short to mid-term plans to develop this integration with the SMS-service further.

Firstly, we intend to establish a similar integration between the SMS-service and the undergraduate veterinary VLE, EEVEC. This is in order to create a similar SMS-supported logbook for the RCVS Day One Competences required for graduating veterinary (BVM&C) students.
We are also planning to formally evaluate the use of the medical students’ logbook to support and expand upon the positive anecdotal feedback we have received from students.

Integrating the SMS-service with the student’s learning profile has opened up additional ways for students to engage with and maintain their personal learning record. Professional training does not stop at the point of graduation for medical students and so we are also looking at how the current procedural and clinical skills log may integrate with the NHS Education (NES) suite of support tools to smooth the transition to post-graduate training.

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