Learner Engagement in Postgraduate Anaesthesia Speciality Training

Ciana McCarthy
*Anaesthesia Department, University Hospital Galway, Galway, Ireland,* cianamccarthy@gmail.com

Maureen Kelly
*School of Medicine, Clinical Science Institute, NUI Galway, Ireland*

Follow this and additional works at: [https://hpe.researchcommons.org/journal](https://hpe.researchcommons.org/journal)

Part of the *Health and Physical Education Commons*

**Recommended Citation**
DOI: 10.1016/j.hpe.2018.03.010
Available at: [https://hpe.researchcommons.org/journal/vol4/iss4/6](https://hpe.researchcommons.org/journal/vol4/iss4/6)

This Original Research Reports is brought to you for free and open access by Health Professions Education. It has been accepted for inclusion in Health Professions Education by an authorized editor of Health Professions Education.
Learner Engagement in Postgraduate Anaesthesia Speciality Training

Ciana McCarthy a,⁎, Maureen Kelly b,c,d

a Anaesthesia Department, University Hospital Galway, Galway, Ireland
b School of Medicine, Clinical Science Institute, NUI Galway, Ireland
c Civic Engagement, College of Medicine, Nursing and Health Sciences, NUI Galway, Ireland
d HSE Western Training Programme in General Practice, Ireland

Received 21 March 2017; received in revised form 23 March 2018; accepted 28 March 2018
Available online 4 April 2018

Abstract

Purpose: Research has shown continuing medical education improves doctor performance, new educational approaches improving educational outcomes and individual reflection can help identify learner needs positively improving clinical performance. This study addresses:

1. How do doctors on postgraduate anaesthesia specialist training programme engage across Postgraduate Medical Education teaching sessions?
2. What are the enablers and barriers to learner engagement?
3. Using the benefits of a balanced and informative mixed method approach to identify how Learner Engagement can be affected by clicker technology in this specific group.

Methods: A triangulation convergent mixed method approach using 1. Semi structured interviews were conducted with Non Consultant Hospital Doctors 2. A quantitative in class engagement measurement Tool was applied using observers with and without audience response systems. The IEM tool was used in 20 Postgraduate Medical Education sessions. A mixed methods approach was used to integrate findings. Quantitative and qualitative data were analysed separately and integrated. Equal weighting was given to both strands.

Results: 8 semi-structured interviews were undertaken and 20 sessions incorporating Didactic lectures, Case Based Discussion and clicker technology. Most frequent IEM scores for the instructor behaviours were ‘1’[Talking to the class] in all three formats. Most frequent scores for the student behaviours were ‘3’[Listening to the instructor or a talking student/looking at slides or board] in DL and CS (70.1% and 61.3% respectively), ‘4’[Talking to the instructor/reading something to entire class or writing something on the board] in CBD (49.2%). The 4Rs of learner engagement: readiness, reflection, recap and retain are core building blocks of LE before during and after a teaching session.

⁎ Corresponding author.
E-mail address: cianamccarthy@gmail.com (C. McCarthy).

Peer review under responsibility of AMEEMR: the Association for Medical Education in the Eastern Mediterranean Region

https://doi.org/10.1016/j.hpe.2018.03.010
2452-3011/© 2018 King Saud bin Abdulaziz University for Health Sciences. Production and Hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).
Discussion: Postgraduate medical learners engage through the 4 Rs of LE. The wellbeing of the learner cannot be underestimated and is a major influential factor in Learner Engagement. Clickers influence engagement through the enablement and enhancement of the 4Rs.

© 2018 King Saud bin Abdulaziz University for Health Sciences. Production and Hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Keywords: Audience response system; Clicker; Learner engagement; Motivation in learning; Postgraduate medical education

1. Introduction

Lifelong learning is a core attribute of the modern doctor and the literature has shown that it improves doctor performance.1–2 It is known from the literature that the effectiveness of workplace learning programs such as postgraduate medical education (PME) is directly linked to learner motivation.3 The need to create an active learning environment that favours engagement and critical reflection is vital to successful learning.4

Key Terms: Postgraduate medical education (PME) for this study takes the form of one hour didactic lecture in the early hours of the morning before ward rounds. Learners include Non Consultant Hospital Doctors (NCHDs) and consultants in anaesthesia. Instructors are most commonly consultants or fellow NCHDs.

PME is a traditional undefined approach to teaching a large, varied group of postgraduate doctors and multidisciplinary team members would be considered by many in the medical education field as out of date. New educational approaches – such as the use of technology can improve educational outcomes.2 Individual medical practitioner reflection helps identify the learners own needs which positively improves clinical performance.2 Currently there is ongoing research into optimization of the clinical learning environment in PME. However less attention has been paid to identifying key elements of PME namely -learner engagement (LE) and motivation.

1.1. Background

This literature review provides a critical analysis of the major theoretical, empirical and methodological trends and developments that have contributed to our understanding of LE and motivation.

Within this large body of emerging research there is little consensus on definitions of some core concepts. This presents a challenge to researchers. There are numerous descriptions of what defines learner engagement, motivation and interaction (See Box 2 for a list of definitions adopted in this study). According to Kuh learner engagement (LE) is, the time and effort learners invest in studies and other activities to achieve student success.5 The distinction between involvement and engagement has been teased out by Heaslip.6 Engagement refers to both student and institutional activities that lead to desired outcomes of all the stakeholders whereas involvement refers to student activities only.6 This important distinction allows for the identification of factors that underlie motivation to learn, which may in turn lead to engagement. Motivation is the translation of a person's basic psychological needs and drives, filtered through their view of the world, toward an action with an anticipated result.3 Engagement is multifaceted and complex, consisting of behavioural, emotional and cognitive processes. Some authors believe that "We do not have a comprehensive picture of student motivation as they manifest across their educational career".8 Current research encompasses primary, second level and undergraduate learner engagement. It has neglected learner engagement in PME.1,2

Kuh’s definition of learner engagement is, the time and effort learners invest in studies and other activities to student success.5 Engagement refers to both student and institutional activities that lead to desired outcomes of all the stakeholders whereas involvement refers to student activities only.5 Motivation is the translation of a person's basic psychological needs and drives, filtered through their view of the world, toward an action with an anticipated.9

Methods of measuring learner engagement are predominately quantitative: examples include the in class engagement measure tool (IEM)10 and tools measuring vigor, dedication and absorption.11 These tools consist of observational scoring systems. However, the research has not included qualitative, or mixed methodologies in the exploration of learner engagement and this is a shortcoming. Approaches used in the medical field to improve engagement include problem based learning, team based approaches,12–14 psychological support3 and technology (Diagram 1).

The use of new technology such as “audience response systems (ARS)” or “clickers” has been popular
in the medical field with numerous reports of increasing participant engagement, interactivity and self-reflection and systematic reviews reporting its effectiveness. These allow each learner to individually answer questions or give opinions while being anonymous. Ainley suggests that technology increases student engagement by increasing effectiveness, motivation and cognition forming interest in turn motivates and causes further engagement.

Some of the literature identifies the need for more research to discover tangible measures of the effectiveness of technology as a tool to increase engagement. The challenge in appropriately using technology as an aid to educational activities and avoiding it being used as a crutch has been highlighted. Notwithstanding this body of research, understanding how increased engagement arises with these new technologies and how learners engage in the field of PME still needs to be identified.

1.1.1. Theoretical background

Piaget's constructivism is based on the tenet that the role of teaching is not to transmit knowledge from the instructor to the learner; rather knowledge is constructed by the learner. This model of learning suggests that LE and attention is core to learning. It emphasizes the importance and responsibility of the learner to be actively involved in the learning process. This idea of active learning has been incorporated into the majority of today's educational strategies and has resulted in increased participation, retention and educational time. From Piaget in the late 1800s, understanding of the concept of LE and its vital component to learning has blossomed. Today's literature alludes to multifactorial components of learner engagement. "Learners motivation, orientations and states are coloured or shaped by the cognitive, physical and sociocultural forces. The use of technology as an aid to increasing LE is well documented but how this might occur in the postgraduate medical learner is still to be uncovered.

In summary, the literature has shown continuing medical education improves doctor performance. However the underlying factors that constitute learner engagement in PME, and specifically with the use of clicker technology, have yet to be identified.

Postgraduate training in anaesthesia consists of six years encompassing core technical skills, communication, clinical education and professionalism. Anaesthesia PME consists of traditional didactic lecture approach commonly. The focus of current literature in medical education anaesthesia is high fidelity simulation training with literature on LE in the anaesthesia NCHD in traditional didactic, case based and clicker teaching is lacking.

Therefore the overall purpose of this research is to explore, understand and, in turn, explain what learner engagement means in continuing postgraduate anaesthesia speciality training and how one example of the use of clicker technology impacts on LE.

This study addresses the following research questions: How do doctors on postgraduate anaesthesia specialist training programme engage across different PME teaching sessions? What are the enablers and barriers to learner engagement for this cohort of postgraduate medical learners? Using a mixed method approach, identify how Learner engagement can be affected by clicker technology.

2. Materials and methods

This is a mixed methods study. Mixed methods research is a methodology for conducting research that involves collecting, analyzing, and integrating quantitative and qualitative research (and data) in a single study or a longitudinal program of inquiry. The majority of current literature has taken a quantitative approach to identifying the elements of learning engagement. However this methodology is limited in that it portrays and one dimensional insight into LE. The choice of a mixed methods approach provides a triangulated insight into the experience of
learner engagement from the viewpoint of the stakeholders involved and is the most appropriate method to address the research questions in this study.\textsuperscript{29–32}

2.1. Research design

The research method employed in this study is a mixed method triangulation study with a convergence model.\textsuperscript{28,33}

Quantitative tools were employed to measure how learners behave “in context”\textsuperscript{10} while qualitative means were used to explore physical, emotional and mental activities at play before, during and after attendance at the teaching session. The merging of data occurred at the compare and contrast stage ()

2.1.1. Setting, sampling and recruitment

The setting was a tertiary referral teaching hospital with 400 NCHDs.

The sample was the 30 NCHDs of the anaesthesia department who attended mandatory postgraduate continuing medical education, as part of their higher specialist training in anaesthesia. Postgraduate medical education normally consists of a lecture 07.30–08.30 daily. Commonly the sessions take a didactic approach with others being case-based discussion or the utilization of clickers.

Recruitment was by purposive and snowballing sampling. Participation was voluntary and participants were contacted through email with two reminder emails. All 30 NCHDs gave consent to quantitative data collection and all who volunteered for qualitative data collection ($n = 8$) were interviewed. The timeline was a 12 month period from 2015–2016.

Ethical approval was obtained from the hospital ethic board. Informed written consent was obtained.

2.1.2. Data collection and analysis

Quantitative data was collected using the In-class Engagement Measure (IEM) tool, a validated method of collecting observational data in the setting of PME identifying how learners behave “in context”.\textsuperscript{10} IEM consists of a list of instructor and student behaviour scales from non-participating personal behaviours to gradually increasing levels of communication with the instructor and other learners, please refer to the Appendix C for a full description.\textsuperscript{10} The IEM tool was used in 20 PME teaching sessions three with Audience Response Systems, clickers. This consisted of

<table>
<thead>
<tr>
<th>Observed class type and characteristics:</th>
<th>Mean number of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class Type</td>
<td>Number of 5 min cycles</td>
</tr>
<tr>
<td>Didactic lecture</td>
<td>7 cycles $\times$ 10 lectures</td>
</tr>
<tr>
<td>Case based discussion</td>
<td>7 cycles $\times$ 7 classes</td>
</tr>
<tr>
<td>Clicker session</td>
<td>7 cycles $\times$ 3 classes</td>
</tr>
</tbody>
</table>

lecture topics discussed with intermittent multiple choice questions, 10 didactic lectures and 7 case-based discussions. Two independent observers ran multiple 5 min observation cycles throughout the teaching sessions. These observers were trained NCHDs.

In all sessions the same two observers were used to reduce inter observer variability. A pilot was conducted before the study to ensure inter-observer agreement on scoring. These scores were analysed using Microsoft Excel\textsupersoft for inter-observer agreement, using Cohen’s $k$ coefficient. Descriptive statistics were used to determine frequencies and median scores of instructor and student behaviours, and the median number of questions asked in different classes.

Qualitative data comprised semi-structured interviews with eight voluntary participants from the same sample over 12 months. The questions on the topic guide were informed by the literature review and study aims. Interviews were conducted, one-on-one lasting an average of 30 min by the primary investigator. This data was audio recorded and transcribed verbatim. Each interviewee was assigned a numerical code on entry into the study.

A pilot interview was conducted to determine of the topic guide was appropriate. Minor modifications were made to the topic guide after the pilot interview. The topic guided consisted of 15 open ended questions exploring the physical, emotional and mental activities at play before, during and after attendance at the teaching session. The final question invited the participant to comment on any additional insights and perceptions not addressed by the topic guide.

The data was coded using Nvivo\textsupersoft software. Data were analysed using Braun and Clarke’s thematic analysis method.\textsuperscript{33} This involves six step guide provides a clear framework for data analysis that includes familiarising yourself with the data, creating codes, identifying themes, reviewing and reflecting on themes, defining and naming themes and analysis. The principal investigator conducted
Table 2
Instructor and student observation scores, and number of questions asked by instructors and students in each class type.

<table>
<thead>
<tr>
<th></th>
<th>Didactic lecture median (min-max)</th>
<th>Case based discussion median (min-max)</th>
<th>Clicker session median (min-max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructor</td>
<td>1 (1–2)</td>
<td>1(1–2)</td>
<td>1(1-1)</td>
</tr>
<tr>
<td>Student</td>
<td>3 (1–4)</td>
<td>4 (1–5)</td>
<td>3(1–5)</td>
</tr>
</tbody>
</table>

Inter observer agreement ratio on instructor behaviour scores had k coefficient was 0.7778 (p = 0.000, 95% CI 0.61–0.96).

Inter observer agreement ratio on student behaviour scores had k coefficient was 0.6842 (p = 0.000, 95% CI 0.6664–0.9211) http://vassarstats.net/kappa.html.

phases 1 and 2 of coding while phases 3–5 were co-analysed with the second author.

Quantitative and qualitative data were analysed separately initially then merged and integrated. Please see appendices A and B. Equal weighting was given to the quantitative and qualitative strands of the study. Using the quantitative data to enrich and elaborate on the quantitative and qualitative strands of the study. See appendices A and B. Equal weighting was given to separately initially then merged and integrated. Please see appendices A and B. Equal weighting was given to the quantitative and qualitative strands of the study.

3. Results

3.1. Descriptive statistics

Average number of Student participants 25.6 [21–30], with a response rate n = 26 for quantitative and 8 number of interviewees for qualitative. The number of teaching sessions was 20.

Mean Age 31 with 68% Male. The most common stage of training was year 3 of 6.

3.1.1. Quantitative data

Inter observer agreement ratio on instructor behaviour scores was 80% and k coefficient was 0.78 (p = 0.00, 95% CI 0.61–0.96). Observers agreed on 72% of the observed student behaviour scores and kappa coefficient was 0.68 (p = 0.00, 95% CI 0.67–0.92).

Most frequent IEM scores for the instructor behaviours were ‘1’ [Talking to the class] in all three DL (Didactic lecture), CBD (Case based Discussion) and CS (Clicker session) (61.2%, 54.7% and 42%, respectively). Most frequent scores for the student behaviours were ‘3’ [Listening to the instructor or a talking student/looking at slides or board] in DL and CS (70.1% and 61.3% respectively), ‘4’ [Talking to the instructor/reading something to entire class or writing something on the board] in CBD (49.2%). Median instructor and student behaviour scores in three observed class types have been presented in Table 2 with the median numbers of the questions asked by the instructor and students.

3.1.2. Qualitative data

Two primary themes emerged from the qualitative data: Theme 1) Learner wellbeing described by the subthemes of physical factors and emotional factors and Theme 2) Learner Engagement, described by four Rs - readiness, reflection, recap and retention. This latter theme is a novel view of learner engagement, the four Rs emerged, as subthemes after much analysis and reflection on the results. Direct quotations are in italics, identified by the assigned number of the interviewee.

3.2. Theme one: wellbeing

Factors within and outside the control of the learner had a large impact on learner well-being, which in turn impacted significantly on learner engagement. These can be broken down into subthemes of physical and emotional factors, but there was significant overlap and interplay between the two.

The major physical factors were the presence of supplied breakfast; adequate seating and ambient environmental temperature all of which enabled learning engagement. Unprotected teaching time with unnecessary interruptions was a prominent barrier leading to distraction and learner disengagement.

“I have previously worked in other jobs where it was religiously protected teaching time no one ever interrupted it. Unless it was dire emergencies- all three bleeps I answered during that lecture were not emergencies.” Interviewee 789
Fatigue and hunger were two physical factors which were unanimously held to inhibit engagement. This included being post call which in turn linked into the emotional wellbeing of learners. The perceived pressure to attend teaching regardless of learner physical fatigue had a negative emotional impact causing anxiety and stress.

Negative emotional factors including anxiety and inattention were more evident towards the end of the teaching session as the impending morning duties drew closer.

"if you know that you need to be somewhere at a set time that can kind of impact on your because you are kind of worried about oh I need to leave soon." Interviewee 776

Learners' emotional well-being was also impacted by the instructor directly questioning them. Participants had divergent views on whether this was negative or positive. By the minority, questioning was seen as a technique that initially raised learner's emotional stress and took a while to get comfortable with but when they acclimatised, they reaped the benefits. Benefits included better retention of information, the opportunity to formulate a point and the opportunity for feedback.

“I would still be a little bit stressed about the fact that I might be called onto answer and you are always a little bit worried about sounding ridiculous or not knowing the answer. But I suppose having done a number of them you get used to the format and so you get better at giving a structured answer. So I suppose over time you are actually learning and getting better at it." Interviewee 008

However, for the majority of participants questioning brought on feelings of emotional anxiety, thoughts of being targeted and fear of ridicule if they answered incorrectly. The emotional pressure felt, by fear of an impending question limited the ability to interact and engage in the session by many.

"if you are threatened if you feel anxious if you suggest anything and you are ripped, torn to pieces or knocked down or mocked in front of others teaching through humiliation." Interviewee 609

"You have to really like listen too especially like if there are like those as you say the problem based scenarios. So like you have more and more information you have to know what happened on the last slide to answer actually the next question" Interviewee 609

Male participants found identifying the mental and emotional factors involved in LE more challenging compared to the females.

Theme two Learner Engagement- described by the 4 Rs.

The 4 Rs of LE include readiness, reflection, recap and retention. These four words, describe the sub-themes and together capture participants' perceptions of learner engagement in PME. Participants felt that these four Rs had input from both the learner and the instructor.

Academic Readiness: The learner's active learning prior to the teaching session included revising the topic beforehand and identifying prior knowledge. Participants felt that this active learning could only be enabled if the instructor gave adequate prior notice of the upcoming topic. This requires that the instructor prepare for the upcoming topic and communicate this to the learners. This interdependence between the instructor and the learner is demonstrable throughout the educational session.

“I read up on it a little bit just to get an overview and have a kind of a background on what the topic is going to be ....” Interviewee 314

“I come to the teaching session with a sense of awareness of what the session will be about and then I could sense for myself what I want to get from that.” Interviewee 776

Reflection: Participants perceived that the process of reflection occurs before and during the teaching session. Prior to the session, they reported that reflection can only be enabled if readiness has taken place. This is a separate entity whereby gaps in their knowledge are identified by the learner themselves.

During the session the ability of the learner to reflect is enabled by the instructor by Problem Based Learning/Case Based Discussion, making the session applicable to day-to-day practice and asking the learner their approach to scenarios and implementing their critical thinking.

Participants identified that interdependence is evident here also requiring an instructor who is well informed on the prior knowledge and experience of the learners to maximise the relevance and positive learning outcomes of the teaching sessions, and with the use of PBL/CBD.
"You know if you have no idea what they are talking about clearly the slide isn’t relevant or else they are pitching it at a wrong level." Interviewee 789

"You find yourself like in this thinking process as you would be over there so first they have some part of the information we try to discover what is that and then they give you more." Interviewee 221

Recap: The use of signposting and summarising throughout the teaching session by the instructor was thought to aid engagement and the final R (retention). Participants saw that was demonstrated with the aid of the clickers which can be used to summarise and evaluate the material just covered by the teaching session.

"Its actual they [the questions posed by the clickers] teach you a little bit, they go back to make sure you have a clue what they are talking about and then they move on to the next section. So it’s kind of a little bookmark at the end of every little segment so for the person delivering the lecture it kind of makes it a little bit more organised.” Interviewee 221

They also felt that recapping helps the late attendee engage in the session by identifying where you are in the topic session. It emphasises and enforces key messages. Repetition in educational ways aids engagement.

Retention: According to participants the use of the previous three Rs enables retention. They viewed retention is the responsibility of the learner and instructor. The instructor, was seen to have an under recognised responsibility for learner engagement.

"I actually tend to read afterwards you know.” Interviewee 725

Further discussion on the topic with peers and consultants after the session by the learner was also thought to enhance the retention of information.

"Or I talk with the consultants when I am with them on during like the day in the theatre about what was just taught.” Interviewee 725

Impending examinations were seen as influencing the quantity of extended reading undertaken.

"Personally I think its enabling I respond to pressure and I study for exams definitely a lot more diligently then if I am just I am reading over a topic.” Interviewee 789

3.3. Merging of the data

This integration consists of combining the qualitative data in the form of text with the quantitative data in the form of numeric information. This integration is achieved by reporting results together in a discussion section of a study by reporting first the quantitative statistical results followed by qualitative themes. With support from the integration through the use of tables that display both the quantitative and the qualitative results.28

Theme one: Learner wellbeing.

There was convergence of the quantitative and qualitative data with respect to the importance of learner wellbeing to engagement. The quantitative data supported and reflected the impact the physical environment had on engagement with less engagement in those standing and when the room was overheated. Unprotected teaching time with unnecessary interruptions was highlighted in the qualitative data as a prominent factor causing distraction, disengagement and undue stress. This was reflected in the quantitative data with numerous interruptions with active bleeps and people coming and going. Pressure to attend to morning duties in a timely fashion was evident with increasing anxiety and inattention towards the end of sessions. This was reflected in both data sets.

There was divergence of evidence between the two data sets on the emotional wellbeing of learners and how questioning impacted on this. The majority of participants portrayed negative attitudes and experiences to direct questioning. Interestingly a contrast became evident whereby learners highlighted earlier their preference for case based approaches enhanced their engagement and their dislike at direct questioning. Yet from our IEM observation tool (Table 2) it became evident the most questions posed to the group by the instructor were in CBD median of 10 (1–13) compared to DL and CS with a median of 8 each. Which is a discrepancy, as you would assume the teaching method with the most questions posed would be disliked by the majority yet CBD was more favoured.

This demonstrated insight that maybe even the participants were not aware of, questioning in the correct format such as CBD enhanced the experience and engagement. This again highlights the responsibility of the instructor to format teaching in a non threatening warm open environment.
Trends on IEM observation (Table 2) showed less questions asked by students during CS median of 1 compared to three for DL and six for CBD, which could suggest decreased engagement or engagement through other means such as answering questions digitally. This idea of engagement through other means (cognitive) such as clickers was identified by participants in interviews and has been unidentified by quantitative data. Demonstrating the complementary benefit of qualitative data.

“You have to really like listen too especially like if there are like those as you say the problem based scenarios. So like you have more and more information you have to know what happened on the last slide to answer actually the next question”  Interviewee 609

Unsurprisingly each participant easily identified the actions involved in LE and found identifying the mental and emotional factors involved a more challenging process. This was more noted in the male participants compared to the females. This may suggest the female participants in this study might be more aware of their mental and emotional process or their increased ability to communicate these processes.

Theme two: Learner Engagement described by 4Rs.
Merging of the data sets brought a three dimensional shape to the dynamic process that is LE.

The qualitative data collection and analysis allowed for a deeper appreciation of the behind the scenes advanced preparation on the part of both the learner and the instructor that were essential enablers of learner engagement.

The process of reflection that occurs before and during the teaching session required both combinations of qualitative and quantitative datasets. Identification of the learners own personal gaps of knowledge requires a skilled experienced open minded learner. During the session the ability of the learner to reflect is enabled by the instructor by problem based or case based learning and encouraging critical thinking. This was mirrored by the IEM observation tool (Table 2) showing a median score of 4 (1–5) case based compared to didactic lectures having a median score of 3 (1–5). Again dependence on a skilled well informed instructor with prior knowledge of his/her audience is crucial.

Recapping is a fundamental process in educational teaching that is not new and has proven positive impact. This has been reflected in both qualitative and quantitative data with the use of clicker technology whereby the technology aids recapping and revision of the session, interactivity and self-reflection, apply new knowledge or “cognition forming interest” and giving instant feedback to the learner and instructor while having an element of competition involved.

“Is actual they teach you a little bit, they go back to make sure you have a clue what they are talking about and then they move on to the next section. So it’s kind of a little bookmark at the end of every little segment so for the person delivering the lecture it kind of makes it a little bit more organised.” Interviewee 221

The use of the previous three Rs enabled retention. Traditionally retention was the responsibility of the learner with recommended reading and rereading of the information. Yet the instructor has an under recognised responsibility for LE with retaining new knowledge with technology such as clickers aiding cognition forming interested as previously mentioned.

It is evident that each ‘R’ is a link in a chain that can influence and effect the next. While each can work independently to effect learner engagement, for maximum positive impact each ‘R’ needs to be optimised and exploited by both the learner and the instructor.

4. Discussion

This study addressed the following research questions in the context of anaesthesia trainees in a university teaching hospital. 1. How do doctors on postgraduate anaesthesia specialist training programme engage across different PME teaching sessions? 2. What are the enablers and barriers to learner engagement? 3. Using the benefits of a more balanced and informative mixed method approach to identify how learner engagement can be effected by clicker technology in this specific group. Using a mixed method triangulation study with a convergence model, this study found that postgraduate medical learners engage through the 4 Rs of LE (readiness, reflection, recap and retention). The wellbeing of the learner cannot be underestimated and is a major influential factor in LE that must be considered by all parties involved in learner needs. Clickers influence engagement through the enablement and enhancement of the 4Rs of LE and the indirect positive effect on wellbeing.

On completion the study has created a novel approach to learner engagement of the 4 Rs which have been readiness, reflection, recap and retention. The wellbeing of the learner cannot be underestimated and is a major influential factor in LE that must be considered by all parties involved in learner needs. Clickers influence engagement through the enablement
and enhancement of the 4Rs of LE and the indirect positive effect on wellbeing.

The constructivist model of learning suggests that learner's engagement and motivation are important in learning.

Postgraduate medical learners engage through the 4 Rs of LE (readiness, reflection, recap and retention). The 4Rs could be seen as the core building blocks of LE. These elements were evident throughout the study. The hidden under-recognised role of the instructor in enabling learner engagement has been highlighted by this study. By utilising mixed methods this study brings a fresh triangulated view of learner engagement. It brings more questions, are these actions learned from a young age and applicable throughout the educational career and becoming second nature to these learners? And are these factors of active learning only relatable to this cohort? It became clear that this approach to engagement seems to be a recipe for success among this study's participants. This idea of active learning has been incorporated into the majority of today's educational strategies and its importance as it has shown increased participation, retention and learner centred time.24 This cohort is high achieving from early on in their educational career to attain a place in medicine. The wellbeing of the learner is becoming a recognised as an important factor. We highlight the influence of wellbeing and the influences of positive and negative stress.

The subtopic of direct questioning through teaching sessions was an important consideration with most participants having views, many of which were divergent. This study highlights the effectiveness of questioning but in the right setting and posed appropriately by the instructor in a non-threatening fashion. This has a positive impact on LE but also on mental and emotional wellbeing.

The value of a well-informed instructor with a targeted teaching strategy to his/her audience has been to date under recognised in the literature.36 This study highlights the responsibility of the instructor to enable the learner to complete each of the 4Rs of LE. An instructor who knows the audience he/she is presenting to and the audience's level of knowledge were key aspects. This idea of targeting your audience is a basic concept highlighted in the literature for effective transfer of knowledge and the ability to alter this level as required throughout the session to the audience.37

Clickers influence engagement through the enablement and enhancement of the 4Rs of LE and the indirect positive effect on wellbeing. Retaining new knowledge is enhanced by technology such as clickers aiding cognition forming interested as previously mentioned. This study reinforces the positive effects already known about clickers with mixed method approach not common in the literature.

Limitations of this study include a small cohort of 30 participants in a subspecialty of medicine. The variation in frequency of different learning sessions may have had an impact on statistical analysis of the quantitative arm. The cohort contained a broad range of years of experience in the medical field maybe giving a more generalized applicable results. Yet this study would need to be applied to other medical specialities for comparison and contrast. This study looked at LE through the eyes of the learner. The investigation of the instructor in LE requires more in-depth study and analysis.38,39

5. Conclusion

In summary postgraduate medical education is the responsibility of both the learner and the instructor. Postgraduate medical learners in anaesthesia, engage through the 4 Rs of LE (readiness, reflection, recap and retention). The wellbeing of the learner cannot be underestimated and is a major influential factor in LE that must be considered by all parties involved in learner needs. Clickers influence engagement through the enablement and enhancement of the 4Rs of LE and the indirect positive effect on wellbeing.

Disclosure

Ethical approval has been granted from University College Hospital Galway Ethics Review Board on December 2015 Reference number CA 1369.

Funding

None.

Other disclosure

None.
### Appendix A: Table demonstrating reasoning for choice of study design

<table>
<thead>
<tr>
<th>Study Design</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Reasoning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Triangulation Design</strong></td>
<td>Most common approach, brings together the different strengths and non-overlapping weaknesses, Single phase, Four subtypes,</td>
<td>Expertise required in concurrent data collection, questions arise if/when qualitative and quantitative data do not agree</td>
<td>The most appropriate as it brings together the strengths of both approaches to get a deeper understanding of the questions we pose</td>
</tr>
<tr>
<td><strong>Embedded Design</strong></td>
<td>Used when one approach is a support or secondary role to the primary approach, traditionally more quantitative, one or two phase approach, two variants</td>
<td>Must specify the reason for the supportive data, difficult to integrate results which are asking different questions</td>
<td>This study wants an in-depth answer to the same set of questions, not different questions, this approach is not the most appropriate</td>
</tr>
<tr>
<td><strong>Explanatory Design</strong></td>
<td>Qualitative data builds on quantitative data, two variants, straightforward to implement, reported in two phases, quantitative appeal</td>
<td>Time consuming, using the same or different samples for each phase</td>
<td>Time limited study, ethical issues, not the most appropriate in this case</td>
</tr>
<tr>
<td><strong>Exploratory Design</strong></td>
<td>Results from the first method inform the second method, two phase approach, straightforward design,</td>
<td>Time consuming, difficulty predicting second phase approach to ethics, same of different participants for second stage</td>
<td>Time limited study, ethical issues, not the most appropriate in this case</td>
</tr>
</tbody>
</table>

(Creswell, 1999).
Appendix B. : Table demonstrating the integration of qualitative and quantitative data

<table>
<thead>
<tr>
<th>Research question</th>
<th>Theme</th>
<th>Theme</th>
<th>Theme</th>
<th>Qualitative data</th>
<th>Quantitative data</th>
</tr>
</thead>
<tbody>
<tr>
<td>How do postgraduate medical learners engage?</td>
<td>Readiness</td>
<td>Reflect</td>
<td>Recap</td>
<td>Retain</td>
<td>Semi-structured interview</td>
</tr>
<tr>
<td>What are the enablers and barriers to learner engagement?</td>
<td>Readiness</td>
<td>Wellbeing</td>
<td>Direct Questioning</td>
<td>Semi-structured interview</td>
<td>IEM Tool</td>
</tr>
<tr>
<td>How is learner engagement effected by technology such as clicker technology for this study?</td>
<td>Reflect</td>
<td>Wellbeing</td>
<td>Direct Questioning</td>
<td>Semi-structured interview</td>
<td>IEM Tool</td>
</tr>
</tbody>
</table>

Appendix C. : Measuring in-class learner engagement

Date and hour:
Observer’s name:
Class title:
Instructor’s name:
Number of students:
Special notes: Didactic lecture, Case based discussion, Clicker session

BEHAVIORS
Instructor
1. Talking to entire class while all the students are passive receivers
2. Telling/asking to one or a group of students, or teaching/showing an application on a student
3. Starting or conducting a discussion open to whole class, or assigning some students for some learning tasks
4. Listening/monitoring actively discussing one or a group of students
5. Listening/monitoring actively discussing entire class

Other:
Student
Student 1 Student 2 Student 3 Student 4
1. Engaged with non-educational material/browsing a book/notes/whispering to a friend etc.
2. Reading or writing something (including following the lecture from a published material or taking notes)
3. Listening to the instructor or a talking student/looking at slides or board
4. Talking to the instructor/reading something to entire class or writing something on the board, flipchart etc.
5. Talking/discussing with one or a group of students on the subject matter

Other:

<table>
<thead>
<tr>
<th>Cycle 1</th>
<th>Cycle 2</th>
<th>Cycle 3</th>
<th>Cycle 4</th>
<th>Cycle 5</th>
<th>Cycle 6</th>
<th>Cycle 7</th>
<th>Cycle 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructor:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Student 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of questions asked</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Student 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Student 3</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Student 4</th>
</tr>
</thead>
</table>

References


Dr Ciana McCarthy, Specialist Anaesthetic Trainee, Anaesthesia Department, University Hospital Galway, Galway, Ireland

Dr. Maureen Kelly. Lecturer Discipline of General Practice, School of Medicine, Clinical Science Institute, NUI Galway Vice Dean of Civic Engagement, College of Medicine, Nursing and Health Sciences, NUI Galway/Associate Programme Director, HSE Western Training Programme in General Practice