Learning and teaching stage 4 clinical decision making: progression from novice to expert

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Abstract

Background: This paper describes the development of learning from novice to expert in Stage 4: Clinical Decision Making (CDM) in surgery: Postoperative reflection and review. It also outlines some or the assessment and teaching approaches suitable to facilitate that transition in skill level.

Methods: This paper is drawn from a much broader study of learning and teaching CDM, that used qualitative methodology based on Constructivist and Grounded Theory. Data was collected in individual interviews and focus groups. Using thematic analysis the data were analysed to identify key ideas. All participants worked in the Department of Surgery at one large regional hospital in Victoria.

Results: For each stage there is a sequence of learning beginning from relying on external resources, gradually developing internal resources to guide and direct the learner’s CDM. Those internal resources built through experience include multisensory and kinaesthetic memories that expand to facilitate the ability to cope with complexity.

Discussion: Armed with the mind-map and rubric table included in this paper it should be possible for any senior clinician or teacher to diagnose their trainee’s progression in Stage 4 CDM. This will enable them to tailor their teaching to best match the capabilities of the trainee and to enable to be more effectively targeted.

Conclusion: CDM can be taught and both trainees and senior clinicians can benefit from understanding the processes involved.

Introduction

Clinical decision making (CDM) has long been recognized as a core competency of surgical practice. However, little is known or understood of the detail of how CDM learning develops in a clinical environment and how it changes over time, when the trainee is working with real patients, and with on-going contact with colleagues in a team environment.

Building on the initial work done by the Royal Australasian College of Surgeons (RACS), as described in previous publications, a working party was brought together to explore ways to define CDM. The resultant four stage model was designed to explain some of the complexity of CDM.

Underpinning all of the background research was ‘Cognitive Learning Theory’; a theory that seeks to explain how the mind of each individual works during their learning, and their mental processing of new information with what they have previously learned. It also theorizes about of how an individual’s cognitive processes can be influenced by external and internal factors.
Other theories of learning that are important in understanding how people learn in the clinical environment are:

- Social learning theory emphasizes the importance of observing, modelling and imitating the behaviours, attitudes and emotional reactions of others.  
- Sociocultural theory—the concept of learning being impacted on by, and occurring within, the social and cultural environment,  
- Situativity theory provides a perspective on legitimate peripheral participation and how experience within a social and physical environment (a community of practice) impacts on thinking, learning and the interpretation(s) of knowledge.  

Working within those structures, the larger research project, from which this paper draws its knowledge, aimed to investigate how CDM happens in each of the stages, and to identify ways to improve teaching and assessment of CDM. This paper addresses learning, assessment and teaching in Stage 4 CDM: reflection and review, and provides some suggestions about how that development can be facilitated.

In this paper ‘reflection’ is understood to be a deliberate reconsideration of an experience in order to make meaning of that experience and to learn from it (that is reflection-on-action). ‘Reflection’ usually occurs not long after the event, and may be carried out by an individual on their own, between two people, or in a small group such as a surgical team. ‘Review’ is a second or subsequent consideration and/or discussion about an event, such as occurs within departmental meetings, Audits and Morbidity and Mortality meetings (M&M).

There has been very little research investigating the processes involved in Stage 4 CDM. Exceptions are some fairly recent research literature which addresses learning in that stage. Those studies identified the need to teach the varying depths and complexities of the reflective process, and suggested a series of questions to prompt reflection at different levels and depths: that is

- Describing—What, when, where, who, how?
- Sense-making—How does the situation make you feel? Why did it happen? Was there room for improvement?
- Critical review—Is there anything you could have done/tried to improve the situation?
- Practical application—What will you do differently in the future? How can you prevent similar situations from happening again? And
- Re-enforcement—When a comparable situation happens again, consider whether you have learned from previous experience.

Teaching of Stage 4 CDB can be hindered by some surgical supervisors and trainers that it is a natural ability, and/or that it can be picked up from observing others, by osmosis. Others are assumptions that supervisors and trainers know how to effectively teach individual reflection, and/or that being taught group review will inform junior clinicians individual reflection (see in Results). To counter such assumptions this paper will outline some of the assessment and teaching approaches suitable to facilitate transition in skill level.

Methods

This research is based on Constructivist Theory in which the focus is on interpreting participants’ meanings and the ways they construe their experiences. The methodology is based on Grounded Theory, which was advocates constant analysis and progressive coding and comparison, followed by the development of core categories, evolving into ‘theories’ grounded in the data.

Data have been accumulated through on-going interaction between the researcher and the participants throughout the 4 years of data gathering [2017–2021]. Analysis began from the first data collection and continued until saturation was achieved, that is, until no new themes or insights were found. There were no pre-conceived codes or groupings into which the data were classified; rather the researcher read and re-read through the transcribed interviews and notes taken during meetings [surgical department; Audit; and Morbidity & Mortality Meetings (M&M)], looking for and identifying code words, emerging themes and categories.

Unlike traditional quantitative research requiring large numbers and/or random sampling, in qualitative research participants can be small in number and purposefully selected from a specific group, or groups, which are most relevant to the problem being researched. In this study the first named author drew information from participants with a range of surgical experience across the spectrum from novice to expert. That spectrum included third year medical students during their clinical rotations (26); registrars (HMO’s) and surgical trainees (17); Fellows and Consultants (8). She interviewed participants individually (~40 h) and took notes during the small group discussions/meetings (~ 60 h). All of the interviews and group discussions took place in the workplace where the author had no official position. Data relating to Stage 4 came from both individual interviews (Individual participants were approached via email) and group meetings into which the author was introduced as an observer.

Within this theoretical landscape mind mapping has been the medium chosen to visually illustrate the progressive learnings extracted from participants’ transcripts, whilst the assessment criteria, based on that progression and RACS definitions of ‘Novice; Intermediate; Competent and Proficient,’ are set out in a simple rubric table.

Ethics approval has been granted for the larger research project by Barwon Health (HREC/17/ VICBH/22); Deakin University Human Ethics Committee (2017–198); and RACS Ethics Committee.

Results

In each of the stages of CDM a series of progressive steps or transitions can be traced from the novice’s thinking through to thinking as an expert. Within those progressions CDM expands from simple to complex, with an increasing ability to deal with complex issues.

In the early stages of learning Stage 4 (reflection and review) the external resource needed are feedback from a senior colleague who defines standards and expectations, or feedback from a patient that may prompt the novice to reassess their thinking. Both of which they can later apply to their own reflections. An implication of the
need for informative feedback is that senior clinicians need to pay more attention to developing their trainees’ awareness of standards and criteria of what constitutes effective reflection about their own performance.

There is also a progression in the focus of the surgeon’s reflection or what they learn from that reflection, as well as the degree of emotion expended, that is, once the less experienced surgeon has developed their own internal resources, they move through phases of initially reviewing everything that happened during a procedure they have been involved in; to deliberately paying more attention to any negative components of the experience; and then making choices to continue or change their practices as a result of that reflection (See Table 1: Individual development of Stage 4 CDM reflection, for verbatim examples of data demonstrating these progressions).

Support for the idea that reflection is a natural ability and does not need to be taught, and/or that reflection can be learned by osmosis—by simply being in the vicinity of others reflecting and/or asking questions—are also demonstrated in Table 1 (Reflection not taught/taught).

It is current practice junior clinicians to learn about group reflection and review by preparing and presenting material for team meetings and audits according to set criteria. They also learn through the questions asked by their colleagues and/or seniors around additional clinical details required. In a functional and respectful department they learn appropriate professional behaviour, including being open in reviewing difficult cases and demonstrating a balance between critical feedback and awareness of the need for trust, from observing seniors modelling those behaviours. The same is not so clearly defined for individual reflection (See Table 1: Review meetings).

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Verbatim quotations from participants</th>
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<tbody>
<tr>
<td><strong>Individual development of stage 4 CDM reflection</strong></td>
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<tr>
<td>MS8 It helps me to know what is important and what to not worry about. Because, if I do not know, then I’ll worry about everything. To me, everything is important until I know otherwise.</td>
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<td>T4 It depends on where I am in the learning curve of it. Say, if I am still learning that procedure, then I definitely think about it because, at first, you recognize the big steps. Then, as you do a few more, you recognize some subtleties in there that, at first, you did not even think you needed to worry about.</td>
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<td>T1 I just de-brief to myself. What good things I’ve done for that procedure. Anything that could be improved on. It does not have to be anything major but even just little technical things or communication errors. Anything for that matter, anything I can improve on. Next time, I try to get a little bit better.</td>
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<tr>
<td>R7 So, what do I do in reflecting on the previous operation? I was thinking, ‘Was there anything we could have done better?’ ‘Was there anything that we were concerned about at the time?’ ‘Was there some doubt?’ ‘Is what’s happened a complication of the original operation, rather than just something that has gone wrong?’</td>
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<tr>
<td>S4 I think I’m getting better at not taking it home. I think that comes with—I guess when you first start, I thought that everything was going to go wrong, so it wasn’t until things started going right on a regular occurrence that I started to worry less about things that went smoothly.</td>
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<tr>
<td>S3 I do reflect a lot. On a difficult operation, sometimes on the type of operation. I know in the last few years my approach to things has changed already, based on my experience and reflecting back and finding out how the patient went and thinking, well maybe next time I will not do that.</td>
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<tr>
<td>S5 Often surgeons say they do not sleep well after they have done an operation that’s more difficult or more complex. I think that’s certainly true of me because I am worried about the outcome for the patient. As you get more experienced, sometimes you realize that your worry does not actually help the patient and problems aren’t going to become apparent for the next couple of hours, or the next couple of days. So, as you get more experienced, you tend to worry in more appropriate times. You do not worry when you are lying in bed at night because that’s not helping anyone.</td>
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</table>

**Reflection not taught/taught**

T1 No one teaches these things. I think it is just expected that you will sort it out for yourself - figure it out.

S3 No that wasn’t taught, not really.

S5 I tend to reflect a lot on all the surgery. Sometimes I am doing that in the setting of training. I think that’s a useful exercise for the trainee. So, you might sit there and talk about the good things with the operation, particularly if the trainee was operating. To give some positive reinforcement. But then, identify the areas that could have been done better.

**Review meetings**

*Clinical scenario: An unusual cause of back pain.*

T9 Patient transferred from [name] rural hospital with Chon’s Disease. Had back/lumbar pain for 6 weeks. Laparotomy and Hartmann’s procedure.

Post-op recovering well. Diverticular disease was causing back pain—contaminating disc. We are seeking advice from spinal unit about the patient's spine management to treat a disc infection and as to whether any further surgery is needed. It was a difficult diagnosis to make.

S6 I have not ever seen this condition going to a disc.

S1 Neither have I.

*Clinical scenario: Plan B—Bail-out.*

S1 Patient with abdominal pain—had gastric cancer. The patient really wanted surgical intervention. Patient was told ahead of the operation that if we found significant metastatic cancer we would stop. We closed because of significant metastases and adhesions; no further treatment beyond major pain relief.

*Clinical scenario: Catastrophic outcome following elective surgery.*

T9 Elective robotic ventral hernia repair. Patient had multiple comorbidities including vascular disease and asthma. Deteriorated after surgery in the evening and overnight. Developed blood-stained bowel motions. Vascular team consulted. Died with worsening multi-organ dysfunction in ICU.

S6 Deciding not to operate was the only other option.

S1 Shared decision-making with the patient is important. They were part of the decision-making and wished to have the procedure. Should we have refused to do it?
In Stage 4 CDM: reflection and review, clear and accurate feedback is needed to enable a novice to develop some level of internal standards and criteria, the novice surgeon reflects on ‘what I did’ and asks themselves a series of questions about each step of the procedure. Initial simple reflection is descriptive; the next stage is evaluation (‘what went well—what needs more work?’) followed by sense making (‘why did this happen?’); then critical review (‘what can I/we learn from this’); and practical application (‘what can I do differently next time?’).\(^{12-14}\) (See Fig. 1).

Whilst previously described concepts about the depth and breadth of reflection have included descriptions of the questioning sequence, they have not identified the learning sequence or the kinds of experiences required to achieve expertise in Stage 4 CDM reflection as outlined above.

**Discussion**

This study aimed to explain the progression from novice to expert in Stage 4 CDM and to provide tools (Fig. 1 and Table 2) that would enable a senior clinician or teacher to tailor their teaching to best match the capabilities of the trainee.

‘Diagnosis’ is a teaching approach that is applicable to all Stages of CDM. Just as for a medical diagnosis when a medical practitioner seeks information by observing and questioning; framing their findings against certain criteria, drawing on their own pre-developed illness schema, and developing hypotheses, so too, with the aid of the above information in Figure 1 and Table 2, a surgical trainer and/or supervisor can diagnose the level of performance of their junior team members. This determination will then provide the teacher with cues about what is needed to either remediate, or push their trainees to gain new insights.

Asking probing questions is a component of the diagnosis process. Using thinking aloud protocols a supervisor/trainer can, for example:

- invite a novice to say what they are thinking;
- explain, summarize, or analyse their thoughts;
- explain, summarize, analyse their operative experience;
- evaluate their performance, identifying reasons that any critical incident happened, and what can be improved.

‘Scaffolding’ is the name of another teaching approach that is applicable. Scaffolding follows logically after diagnosis. It involves...
setting challenging tasks, slightly more difficult than their current level of performance, and then gradually reducing the support and guidance in response to the novice’s progressive competence at that task.

The following rubric table (Table 2) has been designed to assist in those processes of diagnosis/assessment. It is based on data from the larger research, plus information from RACS (2012) and the Tripartite CDM model.

Because reflection is a skill which develops through a sequence of steps [as outlined above under probing questions] which need to be taught senior clinicians need to:

- First evaluate their own assumptions of reflection as a natural ability, or a skill to be learnt.
- Understand the progression of development within reflection and scaffold the learning of their junior team members’ reflection by both modelling the next step, and by asking questions that will encourage that learning.
- Because critical thinking and reflective processes are usually invisible and tacit supervisors need to become explicit about the standards of work and of reflection they apply to themselves, and that which they apply to their trainees. They also need to model their own reflective practices.

### Table 2 Rubric for diagnosing stage 4 CDM

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Novice</th>
<th>Intermediate</th>
<th>Competent</th>
<th>Proficient</th>
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<tbody>
<tr>
<td>Reflecting Emotional response</td>
<td>• Worries about everything—over anxious—over confident</td>
<td>• Worries about the negatives—can explain reasons why problems arose</td>
<td>• Worries at appropriate times if and when needed</td>
<td>• Supports and advises other through the development of reflection</td>
</tr>
<tr>
<td>Evaluation/self-analysis</td>
<td>• Evaluation tends to be superficial without probing</td>
<td>• Key decision processes are identified and evaluated</td>
<td>• Accurately evaluates decisions and choices</td>
<td>• Demonstrates open and honest self-assessment to others</td>
</tr>
<tr>
<td>Stage 1 diagnosis and management</td>
<td>• No cogent identification for improvements</td>
<td>• Has insight into what needs to improve</td>
<td>• Identifies what they will do in the future to prevent similar situations</td>
<td></td>
</tr>
<tr>
<td>Management plan</td>
<td>• Explains the reasoning behind the diagnosis</td>
<td>• Considers other possible diagnoses given the outcome</td>
<td>• Evaluates diagnosis against outcomes</td>
<td></td>
</tr>
<tr>
<td>Stage 2 preparing for a procedure</td>
<td>• Reviews only the steps</td>
<td>• Includes CDM in their review</td>
<td>• Is prepared to revise future planning</td>
<td></td>
</tr>
<tr>
<td>Plan ahead</td>
<td>• Summarizes the key points of the plan</td>
<td>• Compares outcome with planning</td>
<td>• Analyses strengths and weaknesses of the plan</td>
<td>• Critiques own and others planning in order to improve</td>
</tr>
<tr>
<td>Organization</td>
<td>• Judges manipulative skills and tissue care</td>
<td>• Critiques technical skills and identifies some areas for performance</td>
<td>• Critiques own technical skills and identifies all areas for improvement</td>
<td>• Clearly articulates their reasoning when plans have been changed</td>
</tr>
<tr>
<td>Stage 3 intraoperative performance</td>
<td>• Evaluates CDM performance from own perspective</td>
<td>• Evaluates CDM performance from patient perspective</td>
<td>• Takes responsibility for their CDM performance and outcome(s)</td>
<td>• Assists others to evaluate their performance in a balanced manner</td>
</tr>
<tr>
<td>Technical skills</td>
<td>• Evaluates CDM performance from own perspective</td>
<td>• Effective communication to all theatre team</td>
<td>• Conducts team debriefing when necessary</td>
<td>• Assists others to evaluate their performance in a balanced manner</td>
</tr>
<tr>
<td>Communication</td>
<td>• Takes responsibility for safety protocols</td>
<td>•</td>
<td>•</td>
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</table>

### Conclusion

Through diagnosis of a novice’s level of performance in Stage 4 CDM a supervisor/trainer can target and scaffold their teaching to better match the needs of each individual trainee.

### Author contributions

Wendy Crebbin: Conceptualization; data curation; investigation; methodology; visualization; writing – original draft. David Watters: Supervision; writing – review and editing. Spencer Beasley: Supervision; writing – review and editing. Stephen Tobin: Supervision; writing – review and editing. Robbert Duvivier: Supervision; writing – review and editing. Glenn Guest: Supervision.

### Conflict of interest

None declared.
References