Exploring medical students' use of principles of self-explanation and structured reflection during clerkship
Exploration de l'utilisation par les étudiants en médecine des principes d'auto-explication et de réflexion structurée pendant l'externat

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Abstract

Background: While educators observe gaps in clerkship students' clinical reasoning (CR) skills, students report few opportunities to develop them. This study aims at exploring how students who used self-explanation (SE) and structured reflection (SR) for CR learning during preclinical training, applied these learning strategies during clerkship.

Methods: We conducted an explanatory sequential mixed-methods study involving medical students. With a questionnaire, we asked students how frequently they adopted behaviours related to SE and SR during clerkship. Next, we conducted a focus group with students to explore why they adopted these behaviours.

Results: Fifty-two of 198 students answered the questionnaire and five participated in a focus group. Specific behaviours adopted varied from 50% to 98%. We identified three themes about why students used these strategies: as "just in time" learning strategies; to deepen their understanding and identify gaps in knowledge; to develop a practical approach to diagnosis. A fourth theme related to the balance between learning and assessment and its consequence on adopting SE behaviours.

Conclusions: Students having experienced SE and SR regularly in preclinical training tend to transpose these strategies into the clerkship providing them with a practical way to reflect deliberately and capture learning opportunities of the unpredictable clinical context.

Résumé

Contexte : Alors que les éducateurs observent des lacunes dans les compétences de raisonnement clinique (RC) des étudiants en externat, ces derniers font état de peu d'occasions de les développer. Cette étude vise à explorer comment les étudiants qui ont utilisé l'auto-explication (AE) et la réflexion structurée (RS) pour l'apprentissage du raisonnement clinique pendant la formation préclinique, ont appliqué ces stratégies d'apprentissage pendant l'externat.

Méthodes : Nous avons mené une étude séquentielle explicative à méthodes mixtes auprès d'étudiants en médecine. À l'aide d'un questionnaire, nous avons demandé aux étudiants à quelle fréquence ils adoptaient des comportements liés à la AE et à la RS pendant l'externat. Ensuite, nous avons organisé un groupe de discussion avec les étudiants afin d'explorer les raisons pour lesquelles ils ont adopté ces comportements.

Résultats : Cinquante-deux étudiants sur 198 ont répondu au questionnaire et cinq ont participé à un groupe de discussion. Les comportements spécifiques adoptés variaient de 50 % à 98 %. Nous avons identifié trois thèmes concernant les raisons pour lesquelles les étudiants ont utilisé ces stratégies : comme stratégies d'apprentissage "juste à temps" ; pour approfondir leur compréhension et identifier les lacunes dans les connaissances ; pour développer une approche pratique du diagnostic. Un quatrième thème concernait l'équilibre entre l'apprentissage et l'évaluation et ses conséquences sur l'adoption de comportements liés à l'AE.

Conclusions : Les étudiants qui ont fait l'expérience de l'AE et de la RS régulièrement au cours de leur formation préclinique ont tendance à transposer ces stratégies dans l'externat, ce qui leur fournit un moyen pratique de réfléchir délibérément et de saisir les opportunités d'apprentissage dans un contexte clinique imprévisible.

Introduction

Medical students are expected to develop their clinical reasoning (CR) skills mainly during clerkship. Despite intensive immersion in clinical practice, students' CR skills increase more modestly during clerkship than during preclinical training.[1,2] Educators observe deficits and inconsistencies in several aspects of students' CR at clerkship such as diagnostic justification, oriented data collection, plausible diagnostic hypotheses generation and appropriate diagnostic decisions.[3,4] Helping students develop useful and adaptive learning strategies could increase their learning from interactions with real patients.

Clinical training takes place in a complex learning environment embedded within medical practice. Many factors may undermine the development of students' CR such as shorter patient stay and inpatient settings where the diagnostic process is already completed.[5] Students perceive few opportunities "to practice or observe comprehensive diagnostic thinking"[6, p.5] or to receive coaching by supervisors. Students may not have developed educational strategies to themselves seize learning opportunities in clinic.[7] Research on CR learning may offer some opportunities to tackle this challenge.

Self-explanation (SE) and structured reflection (SR) are promising educational strategies that foster CR among medical students.[8–10] SE requires that students engage meaningfully while solving a clinical case, and generate for themselves explanations about clinical findings in relation to underlying pathophysiological principles to deepen their understanding and identify ambiguous or missing knowledge.[8,11–13] In SR, students reflect deliberately with specific instructions about a clinical case by comparing, contrasting plausible diagnoses, and prioritizing them.[9-10] SE and SR target knowledge building and support students' illness scripts refinement,[14] which could facilitate diagnostic justification and reinforcing clinical data collection relevant to early diagnostic hypotheses. Given there is no substitute as rich as real patients for learning CR in clerkship, we believe that students using SE and SR strategies would therefore benefit from clinical opportunities.

The objective of this study was to explore how students use SE and SR to support CR development during the clerkship after having experienced these strategies in a structured activity at the pre-clerkship level.

Methods

Context

Within the undergraduate medical program at Université de Sherbrooke, we have implemented an educational intervention combining SE and SR that requires students to individually solve clinical cases using verbal SE and completing a written SR grid.[14-15] This activity uses a digital environment and recurs 11 times over the preclinical years. The Sherbrooke medical curriculum is a competency-based four-year program with 2 1/2 years of preclinical training followed by 18 months of clerkship. The preclinical program is divided into five blocks of activities per year. Each block ends with an integration week where the SE-SR activity takes place, and provides students with opportunities to deepen and apply their knowledge and skills. During the clerkship, students are involved in four-week clinical rotations with no specific instructions to apply SE or SR in clinical training.

Study design

We used an explanatory sequential mixed-methods design[16] with two phases to explore students' uses of the principles of SE and SR during clerkship. First, we surveyed students about behaviours related to SE and SR they adopted during clinical training. The second phase comprised a focus group with students to further explore why they use these strategies to better understand how they transposed SE and SR for learning in clinical contexts. We aimed for a focus group of four to six participants as it was conducted online.[17] We obtained ethics approval from the university's research ethics board (#2020-2563).

Participants

All fourth-year medical students (n = 198) of a cohort (2021) who had completed the SE-SR activity were invited to participate in each phase of the study. We sent invitations by email via the undergraduate medical program and made posts on the students' cohort Facebook page.

Material, procedures, analyses

Phase 1. Using DeVellis[18] 8-step scale development, we designed a questionnaire to assess students' adoption of behaviours related to the principles of SE and SR while involved with real patients in clinical training. We used a layered analysis to identify the principles[14] of SE and of SR and generated relevant items which were then revised by all team members not involved in the item list creation. We pilot-tested the questionnaire with three students. We refined the items and produced a final version.

The questionnaire comprised two sections: one for SE and one for SR. Using a 5-item scale (i.e., Never, Rarely, Sometimes, Often or Always), students had to report how often they adopted each of the 10 behaviours. The questionnaire was in French and administered online with Microsoft Forms. Responses were anonymous.

Phase 2. We developed an interview guide informed by the survey results. We conducted a focus group (one hour) in French to explore why students adopted the behaviours related to SE or SR in clerkship. After presenting the survey results, the research assistant asked students why they adopted these behaviours ("What are the reasons for you to adopt or not these behaviours"), how they perceived their utility ("How useful are these behaviours for you") or their impact on learning ("What is the impact of adopting these behaviours on your learning"). Discussion was audio-recorded and transcribed.

We conducted a thematic analysis proposed by Braun and Clarke.[19] First, team members read the transcript to become familiar with the data. Two members (MC and VB) analyzed the transcript independently to generate a list of preliminary codes. A third member (LB) organized the documents to compare the coding. Members (LB, MC, VB)

met regularly to discuss the coding, the organization of themes, and the links between them, until they reached a consensus. The whole research team then discussed the themes and final coding.

Results

Questionnaire

Fifty-two students (26.2%) responded to the questionnaire. Frequencies of behaviours' adoption are presented in Table 1 for SE, and in Table 2 for SR, and we highlight some results below.

For SE, 90% or more of students report *often or always* engaging themselves to understand deeply the clinical problem, making links with prior knowledge, and trying to identify the limits of their own knowledge. Seventy-five percent of students report *often or always* moving out of their comfort zone by either addressing part of a problem that they don't understand well or by volunteering to face new or challenging clinical problems.

For SR, 80% or more of students report often or always generating hypotheses, justifying them with pros and cons and prioritize them.

Table 1. Percentage of students reporting adopting the behaviours related to self-explanation

Behaviours	Never	Rarely	Sometimes	Often	Always	Often/Always
a) *I engage cognitively to understand the clinical problem in more depth*	0 (0%)	0 (0%)	2 (4%)	32 (62%)	18 (35%)	50 (97%)
b) *I try to make links between elements of the problem and my prior knowledge*	0 (0%)	0 (0%)	1 (2%)	24 (46%)	27 (52%)	51 (98%)
c) *I do the exercise of making links between elements of the problem and pathophysiological explanations*	0 (0%)	3 (6%)	19 (37%)	22 (42%)	8 (15%)	30 (57%)
d) *I use my pathophysiological knowledge to better understand the elements of the problem that I understand less well*	0 (0%)	1 (2%)	19 (37%)	22 (42%)	10 (19%)	32 (61%)
e) *I analyze all the elements of the clinical situation*	0 (0%)	0 (0%)	6 (12%)	36 (69%)	10 (19%)	46 (88%)
f) *For a given clinical situation, I go out of my "comfort zone" to address the elements of the problem that I understand less well*	0 (0%)	2 (4%)	11 (21%)	30 (58%)	9 (17%)	39 (75%)
g) *I volunteer to assess patients with issues that are challenging for me because they are new or more complex*	0 (0%)	2 (4%)	11 (21%)	27 (52%)	12 (23%)	39 (75%)
h) *I try to identify the limits of my knowledge (ambiguous, erroneous, or missing knowledge)*	0 (0%)	0 (0%)	5 (10%)	23 (44%)	24 (46%)	47 (90%)
i) *I continue my personal work in connection with the ambiguous, erroneous or missing knowledge highlighted*	0 (0%)	0 (0%)	6 (12%)	29 (56%)	17 (33%)	46 (89%)
j) *When the situation allows, I think aloud or verbalize my understanding of the problem to deepen it*	4 (8%)	9 (17%)	13 (25%)	18 (35%)	8 (15%)	26 (50%)

Table 2. Percentage of students reporting adopting the behaviours related to structured reflection

Behaviours	Never	Rarely	Sometimes	Often	Always	Often/Always
a) *I generate by myself several plausible diagnostic hypotheses*	0 (0%)	0 (0%)	5 (10%)	21 (43%)	23 (47%)	44 (90%)
b) *I argue for myself my diagnostic hypotheses* *	0 (0%)	0 (0%)	3 (6%)	24 (50%)	21 (44%)	45 (94%)
c) *For a generated diagnostic hypothesis, I identify in the patient the clinical elements that support this diagnosis*	0 (0%)	0 (0%)	1 (2%)	25 (51%)	23 (47%)	48 (98%)
d) *For a generated diagnostic hypothesis, I identify the clinical elements that do not support this diagnosis*	0 (0%)	1 (2%)	6 (12%)	27 (55%)	15 (31%)	42 (86%)
e) *For a generated diagnostic hypothesis, I strive to identify additional elements that could be sought to support this diagnosis*	0 (0%)	7 (14%)	10 (20%)	25 (51%)	7 (14%)	32 (65%)
f) *I repeat the same exercise for the plausible alternative diagnostic hypotheses that I consider*	0 (0%)	3 (6%)	13 (27%)	28 (57%)	5 (10%)	33 (67%)
g) *I compare / contrast in writing the different diagnostic hypotheses by listing the pros and cons of each*	3 (6%)	7 (14%)	14 (29%)	19 (39%)	6 (12%)	25 (51%)
h) *I assign an order of probability to the hypotheses I keep in my differential diagnosis*	0 (0%)	1 (2%)	7 (14%)	21 (43%)	20 (41%)	41 (84%)
i) *For a given diagnostic hypothesis, I reactivate my knowledge of its usual (typical) clinical presentation (predisposing factors, symptoms and clinical signs)*	0 (0%)	1 (2%)	11 (22%)	26 (53%)	11 (22%)	37 (75%)
j) *For a given diagnostic hypothesis, I try to revise or enrich my knowledge of its clinical presentation (predisposing factors, symptoms and clinical signs)* *	0 (0%)	2 (4%)	13 (27%)	24 (50%)	9 (19%)	33 (69%)

*There are some missing data for SR. Percentage have been calculated on 48 responses for b and j, and 49 responses for the remaining items (a, c, d, e, f, g,h, i).

Focus group

We conducted one focus group with five students. We identified three themes about why students adopted behaviours related to SE or SR. A fourth theme related to the delicate balance between learning and assessment and its consequence on adopting specific SE behaviours in a clinical context.

SE and SR used for "just in time" learning. SE and SR are effective and "just in time" learning strategies. They provide students with an approach to reason and organize their reflection about patients' problems. Students can: "ask questions while we are in it, because it is difficult in terms of time and motivation to put yourself back into the reasoning alone in your room at night" (P02). Starting a reflection for themselves helped students raise these questions for a deeper understanding in the moment instead of just moving on. However, using SE requires student engagement: "It is an extra effort that I need to do to really ask myself the question" (P02).

SE used to deepen understanding and identify gaps in knowledge. Students reported using SE to help reactivate prior knowledge and link it with the elements of the case: "If we are able to explain it, it is because we master it" (P05). In addition, when students ask questions to themselves about the problem, it helps them plan their study by "identify[ing] the things for which we are less knowledgeable, so it helps prioritize what to read at night" (P03).

SR used as a practical approach to diagnosis and clinical work. The SR strategy helps students to approach diagnostic tasks in a structured and practical manner, "[…] to prioritize our diagnoses, then, make the right management plan, that is, looking for the right investigations to confirm or not some diagnoses, then choosing what treatments must be initiated in priority" (P01). Using SR also forces students to expand their differential diagnosis limiting premature closure. SR strategy is also perceived to be helpful when facing undifferentiated clinical problems by providing students with a way to initiate diagnostic reflection. Students perceive SR helpful for their clinical work "[…] in the clinical note, instead of writing the entire review of systems, eventually, we focus, and we are more efficient in the patient records file" (P03).

SE and the delicate balance between the learning and assessment stances. Students expressed how, in the clinical context, there is a delicate balance between adopting the learning stance versus the assessment stance because: "[…] even if we are here [clerkship] to learn, we have assessments at the end, we have to juggle with both, looking like we know what we do, following the rhythm, while accepting we are learning, and we don't know everything. It's finding the balance" (P03). This is particularly true when adopting behaviours related to SE exposes gaps or ambiguous knowledge. Residents are perceived as less threatening and the interaction with them appears to facilitate students' SE behaviours: "I often take the opportunity to discuss with junior residents, they are close to us, they understand what we don't understand, and they have nothing to do with our assessment" (P02).

Discussion

Our study aimed to explore students' use of SE and SR in the context of clerkship after having experienced these strategies regularly in preclinical years. Students seem to internalize principles of SE and use them spontaneously when facing difficult, complex cases or gaps in their knowledge. SE is also used to initiate discussion with peers, residents, or supervisors on clinical cases. This may suggest that, while SE is *a priori* an individual strategy in which students generate explanations for themselves,[13] there is an added value of sharing thoughts afterward with other learners or supervisors.[20,21] SR seems to provide students with a practical way of reflecting deliberately about clinical cases by engaging them in the diagnostic process, rehearsing diagnostic approaches to problems, reinforcing clinical data collection relevant to early diagnostic hypotheses, justifying and prioritizing their diagnoses.

SE and SR used in combination while solving cases at preclinical level targets knowledge building and more specifically refinement of students' illness scripts.[14] A vast repertoire of coherent illness scripts provides the arguments, the pros and cons to support or refute diagnostic hypotheses. Using SE and SR regularly with real patient problems could improve students' illness scripts, helping to overcome reported deficiencies in diagnostic justification.[3,4]

SE and SR appear to be not only building knowledge strategies but also practical "just in time" student-driven strategies to get them involved with and allowing them to deliberately reflect about clinical problems presented by patients. Helping students develop a deliberate practice, "an effortful activity conducted with the goal of improving performance,"[22] may improve learning of CR during clerkship, but also over time in their professional practice.

Limitations

Our study has some limitations. The list of behaviours we presented to students were not exclusive to SE and SR since some of the principles are general and shared by other activities of the preclinical curriculum. Student recruitment was limited to one cohort and one focus group, which might limit the transferability of the findings.

Conclusion

SE and SR, implemented in a preclinical training, could help students' CR development during clerkship. These strategies are student-led and might help them further develop illness scripts and improve their diagnostic justification. They may provide students with practical approaches to reflect deliberately and seize learning opportunities in an unpredictable clinical context. Providing explicit instructions on potential uses of SE and SR during clerkship could optimize students' use of these strategies. Researchers ought to consider ways to better understand how SE and SR might be applied by medical students to the clinical context and how these strategies might optimize their learning with peers, residents, and supervisors. Future research should also study more in-depth the barriers and facilitators to the use of SE and SR in the context of clerkship.

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