Medical students' perception of simulation-based assessment in emergency and paediatric medicine: a focus group study.

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**Abstract**

**Background** Simulation-based assessment is scarcely used for undergraduate medical students. We created a simulation-based assessment to validate medical students’ technical and psychometrics’ skills, during their emergency medicine and pediatric curriculum. The aim of our study was to collect medical students’ perception on this novel assessment.

**Methods** This is a qualitative study that includes 9 focus groups among the 215 students who participated in either a pediatric or an emergency medicine simulation-based-course. These sessions ended by an assessment on a manikin. Among the 40 students who were randomly selected to participate in the focus groups, 30 agreed to participate. Data were analyzed using grounded theory and, data were coded the by two independent investigators.

**Results** Seven major and two minor themes emerged from the focus groups. The importance of being certified by simulation to be more self-confident in hospital clerkships, the perception of simulation-based assessment as a high quality assessment, the contribution of the simulation-based assessment to change students’ practices and enhance their engagement in their curriculum and a disappointment because simulation-based assessment didn't help student for the faculty high stakes assessments. Some students also found that simulation-based assessment was a stressful and unfair exercise. The last discussion was about practical issues of the assessment such as this normative way, and about the importance of the feedback.

**Conclusion** The students reported positive aspects of the simulation-based assessment method such as helpful for their hospital clerkship, change of their practices and way of learning. However they also reported that it might be a biased and a stressful assessment method.

**Background**

Following the recommendations of the Accreditation Council for Graduate Medical Education, competency-based medical education (CBME) principles have been widely implemented in most of the medical education systems (1). Among the six domains of general competencies, medical knowledge, practice-based learning and improvement are specifically relevant to improve the safety and quality of patient care. This framework aims to align the medical needs of patients with the outcomes of the students’ training (2). Therefore, student assessments must also meet the requirements of the competency-based approach. Medical education systems are facing a challenge to assess these new domains of competencies with validated and high stakes assessments (3,4).

Simulation-based training (SBT) is now a common, validated learning tool in medical education and has shown its effectiveness on educational and patients outcomes (5–7). It can improve communication, team-work or procedural skills (8–11). Thus, CBME offers the opportunity for the simulation community to participate in a competency-based assessment system, as formative (assessment for learning) or summative assessment (assessment of learning) (12,13). Although the use of simulation for summative
assessment emerged for postgraduate practice or for healthcare’s teams (14,15), it is not widely spread for MS and in emergency medicine.

Although there are many standpoints and research for how to develop, use and evaluate valid and reliable simulation-based assessment of medical students or residents (16,17), there is a lack of knowledge about the learner’s perspectives of this type of assessment. However, reactions and perceptions of the learners about assessment could have and impact of their engagement in the learning process and in the assessment (18,19). Therefore, in a perspective of programmatic assessment, authors recommend to take into consideration the learners’ perceptions (20).

Consequently, we developed two simulation-based assessments within the emergency medicine and the paediatric curriculum, in our faculty. The aim of the study was to collect medical students’ perceptions of these new assessments. We sought to study, and better understand what aspects of simulation-based assessment could be obstacles or advantages for the learner’s.

Material And Methods

We conducted a prospective qualitative research, after submission and validation of the protocol to the French Society of Intensive Care Medicine (SRLF) ethical committee (n°16–55). All participants of the focus groups received written and oral information before involving the study and signed an informed consent. The faculty board also approved these new simulation-based assessments.

Study design and theoretical framework

We used a grounded theory approach to produce emergent themes and theories thanks to the data from the medical students and their perception of simulation-based assessment (21). The focus groups method was chosen to allow discussions between participants in order to generate point-counterpoint discussion and because the whole group experience more important than the individual ones (22). In order to write clearly our approach we used the COREQ framework and its 32-item checklist (23).

Characteristics of the research team

Principal investigator (ALP) made the interviews and constructed the semi-directed interviews with the help of JT, YF, and GLB. YF, ALF, JT and ALP are educators in the simulation program and attending physicians in the emergency department. MCR is an internist doctor involve in the medical students curriculum and pedagogical improvements. AP and NdS are paediatricians and teachers in the paediatrics simulation course. GLB is a professor in Learning Sciences. ALP had a mastered degree in Learning Sciences and a teacher diploma in simulation-based training and had previous training and experience in focus groups interview facilitation.

Setting: description of the simulation-based courses and assessments
The study took place in a single academic emergency and intensive care medicine curriculum (EM-ICMC), and then in a paediatrics curriculum (PC) with four teaching hospitals and 18 urban hospitals, for a total of 39 departments affiliated with Paris Sorbonne University, Paris, France.

Simulation-based course within the emergency and intensive care medicine curriculum

The 125 medical students who participated in the EM-ICM simulation courses were fourth year medical students involved in their "EM-ICM three months clinical rotation and module". Within this EM-ICM module, students had two sessions of three-hour simulation-based training. The setting of the course followed the classic setup starting with the pre-briefing, the briefing, and then the simulation scenario for two or three students followed by a debriefing. In each course, students had to participate in one of the six scenarios lasting 8 to 10 minutes (appendix 1). In each scenario there were three technical and three non-technical learning objectives (for example knowing the advanced-life support algorithm and how to ask for help).

The new part of the program was the simulation-based assessment. It took place during the third course, one or two weeks after the two previous ones. Students were assessed in binomial way. The teacher’s team choose to assess them on the same scenario than those used within the two training courses. The setting of the assessment was likely the same than the classic setup with a pre-briefing, a briefing, and the simulation scenario but it changed for the debriefing. As all the students were observers of each binomial group, the debriefing took place in two stages: the first was immediately after the scenario, involving the teachers and only the two assessed students; the second debriefing occurred at the end of all assessments, involving all the students.

This was a summative assessment. Teachers used a specific score for each clinical case to evaluate the students. The teachers’ team had previously developed the scores specifically, as none existed to assess medical students in emergency medicine. Each scenario had its own score with technical and non-technical skills to assess. To succeed the evaluation, binomials had to complete two conditions: on one hand they had to obtain a grade higher than 10/20, and on the other hand, they had to complete all the mandatory items. If the students failed, they had to undergo another assessment session. If they failed again, they had to take the entire simulation course again (training then assessment).

Simulation-based assessment within paediatrics curriculum

The 90 medical students who participated in the paediatric simulation courses were fifth year medical students, who underwent a paediatric clinical rotation of four months. During this period, each student participates in a simulation-based course that includes three sections. The first was a video projection about paediatric advanced life support. The second section consisted of a 3-hours simulation-based course on paediatrics airways management, cardio-pulmonary-resuscitation (CPR) and global management of respiratory failure in children. Students were divided in groups of ten for each session of the course. The last part of the course was the simulation-based assessment of a paediatrics basic-life
support clinical case with technical learning objectives. The individually assessment took place just after
the end of the course, during a short summative evaluation of each students’ cardiopulmonary
resuscitation performances on an infant, in front of an evaluator using a specific score (Annex 1). In case
of failure, the student was asked to retry the evaluation process immediately after. In case of a second
failure, he/she needed to undergo the whole course for a second time and to repeat the assessment
afterwards.

**Data collection**

The participants were approached throughout their faculty mail. All the 215 medical students involved in
the two curricula received an email to present the simulation courses and to inform them that a study
took place during the same time. Among them, forty (twenty in each curriculum) were randomly selected
and received an email asking them to participate in two focus groups, one before and the other after the
simulation-based assessment. The focus group before the simulation-based assessment was to explore
the nature of their feelings, how they got prepared for the assessment. The focus group after the course
was set to evaluate their perceptions. ALP constructed the interview guide alone, using semi structured
methods with predetermined, open-ended questions and it was pilot tested with voluntary
nonparticipatory students to ensure the questions were appropriate and clear (appendix 2). The focus
groups took place either within the faculty or the hospitals according to the participants’ preference. ALP
didn’t know the participants as they weren’t students in her emergency department. They were unaware
of the aim of the study, only that they were ask to talk about their experiences in simulation-based courses.
At the beginning of the study the interviewer introduced herself as a learner in Learning Sciences and as
an emergency physician but not as a teacher in simulation-based training. In order to promote the
discussions among participants, the interviewer had a facilitator role more than an interview’s conductor.

**Data management and analysis**

ALP audio-recorded and then transcribed in verbatim the focus groups. ALP also made fields notes during
and after the focus groups. The transcriptions were analysed separately by two investigators (ALP, JT).
Focus groups were coded following those stages: familiarization with the transcripts with several
readings identified main themes from the transcripts (they were not defined in advance) then the use of
an open software (Iramuteq) allowed another perspective. We decided to analyse separately the
perceptions of the different assessments in order to identify the differences between the two exercises.
Authors paid attention to the study rigor with the use of several reviewers, who had a reflexivity work
about how their different background (institutional, formation, workplace) may impact the results.

**Results**

**Analysis**

After data analysis, we founded seven major and two minor themes that are listed below, followed by
participants’ quotes. The major themes were those related to the simulation-based assessment while the
minor themes related to the overall simulation-based practice. The major themes are divided in two categories: those that were found in all the focus groups and those that were not found or were contradictory according to the different evaluations (table 2). Students from the pediatric curriculum are quoted as PC + number’s participant and students from the EC-ICM curriculum are quoted as EM + number’s participant.

The entire focus groups reached consensus on 4 major simulation-based assessment themes:

1. One of the shared perceptions of simulation-based assessment was the feeling that even if the perspective of “another assessment is not very rejoicing” (PC8), the feeling of being a "simulation certified student" would help them within hospital clerkships. First they thought it could helped them to be more involved: “it could help me to convince doctors to let me do some practical things” (PC7). Second, after such a certification, they would feel more self-confident in their own abilities compared to the actual validation system: “we can pass the examinations although we don't master everything” (PC3). Simulation-based assessment changes the vision of the students about their place in the clerkship, they felt more prepared to face real emergency situations: “assessment is hard, but when after it, I feel that I saw and manage the worst, and then I could manage a threatening life situation” (EM 2). “It makes me want to go in clerkship” (EM 13). “If I am certificate with simulation, I will feel more confident in clerkship” (PC 11). The discussions also highlighted a common thread between the students: they highlighted the lack of quality assessment during hospital clerkships, and the lack of framework: “Everybody is certificate, even if they didn't know our first name” (EM 17). They also reported unfair and unorganized oral assessment during hospital clerkships: “once a doctor made the evaluation for 20 students on one hour, although it's supposed to be in three” (PC 8)! They noted the extreme variability of instructors and had regrets for that because “to make a good doctor, you need good assessors (PC 11)”. For those reasons they appreciated simulation-based assessment: it would help them and prepare them to face various medical situations, and would certificate more competencies than during their hospital clerkships.

2. The second theme is a strong acknowledgement for the contribution of simulation for the assessment process. For a majority of the students within the nine focus groups, simulation-based assessment represents a high quality assessment with some defaults but with a part of confrontation to the real world which is important for them. “It's like our semiology assessment on real patients: it's unfair, but it's the real life” (EM1). “As with semiology evaluation, we don’t have the assessment in the same rooms, neither with the same teachers but it deserves to exist” (EM2). “It's an assessment with a good quality for measuring our real competencies” (EM3). For them, simulation-based assessment is a “high quality certification, a safe level for validated skills” (PC 12).

3. The third theme concerned the changes to their practices as students. Unlike before other simulation courses, students reported that for these two courses, they studied their lessons before attending the training. For them, the assessment was a “magic world” (PC5) which “forced us to cram for it” (PC10), and that “it helps to deepen and organize [my] theoretical knowledge” (PC2).Finally, assessment is a way for them to be “more motivated to participate” (PC 5) and to have “great
involvement” (PC4) during the simulation course. For the specific EM-ICMC, as they deplore “the lack of specific simulation resources” (EM1), “as videos” (EM4), as practical written documents” (EM1), they made one for each case. And making those tools was actually an exercise of knowledge’s organization: “it helps us to hierarchies” (EM 13), “we insist on the fundamental knowledge, which will be usefulness for our practice latter” (EM 15).

4. Simulation-based assessment did not help students for written assessments, neither for the final assessment of the curriculum, which takes place in the sixth years. “It doesn’t help us to validate our year” (EM 2), “it doesn’t give us bonus points for the EM-ICM module” (EM 17), and “it’s just another assessment” (PC 3). “It doesn’t assess the same knowledge that the written evaluation, so it doesn’t help us” (PC 10).

Three other major themes emerged from the focus groups, but not for the two assessments or in a different way.

1. In the EM-ICMC assessment, which was a more complex assessment, students found that simulation-based assessment was biased because of differences between teachers, clinical cases and binomial teams. Although the teachers had the same score to assess the students, there was a clear disparity between days: some days 25% of the students failed while on other days no students failed. According to the students: “all the scenarios don’t have the same difficulty” (EM 12), “I prefer to have the cardiac arrest or the pneumonia than the medical intoxication” (EM 14). “It makes an unequal framework between the students” (EM 18). This perception of bias did not emerge from the PC students, who had undergone the same assessment, even if the teachers were not the same every day.

2. After the assessment, the nine PC students who participated in the focus groups passed the test. They didn’t report major stress. Only one did, because: “the simple use of the word assessment is stressful” even if she knew it was “easy” (PC 4). They explained they had less stress than before a written assessment because it represented “five months of work, all the program” instead of this assessment regarding only a few skills (PC 2). However, the few minutes before the simulation assessment, they felt more stressed than before a written test because they had to show their skills: “the stress in simulation is mainly due to the other students and teachers’ might think rather than from the assessment in itself” (PC 7). But it’s a “good stress” because it “exists in the real life” (PC 7). Moreover, it’s a better thing to have stress in simulation courses than when facing a patient: “I prefer to make a mistake with the manikin” (PC 7), “we can be ridiculous, and it doesn’t matter with the manikin” (PC 1). Conversely, in the EM-ICM curriculum, simulation-based assessment introduced some stress for all the students and then they deplored a reduction of their interest for SBT, whereas the SBT was an attractive tool for them. “Although we knew the scenarios, it was stressful, more than another assessment” (EM 12); “simulation must be a fun exercise” (EM 3); “normally simulation-based training is nice and friendly….with the assessment it became stressful” (EM 9); “it’s just an unnecessary additional assessment” (EM 15).
3. The last theme concerned the practical issues of simulation-based assessment. Students highlighted the importance of the training before being assessed. For them, the most important thing for developing simulation-based assessment is to “integrate simulation earlier in the curriculum and with a higher quantity than currently” (PC 4). Another discussion was about individual versus team assessment and the role of each student during it. They thought assessment should be done with a student alone, because if they are in teams, “everyone would be happy to take the role of the medical student because it’s a useless and easier role” (PC6). For this reason they would prefer to be alone. But, they noted that “in real-life you’d never be alone, you work in a team and you have to learn team work” (EM 2). After the nine focus groups they didn’t find an agreement for this specific endpoint.

The third discussion was about summative evaluation. They all thought that’s they need a normative one, because “tests in which you can always pass just because you were present are useless and unbearable” (PC 2). To have a real objective, with a real “sanction” is much more interesting for them. They discussed the interest of a validation with a score or only with a binary validation and in a majority, they found that a score could help to, “fix the threshold very high” (PC 11) but “the most important is to succeed, not to be perfect” (EM 13). All of them reported “some rotten scores” (EM 8), “a real scandal with unfair scoring” (PC 6), and underlined the fact that it had to be an objective score. All the students underlined that one other positive aspect of simulation-based assessment was the possibility to have a debriefing immediately after the test which: “it’s a personal interest and provides feedback” (EM 12); “it’s a big difference from the others assessment tools” (EM 15).

The minor themes were those related to the perceptions of the issues of the simulation-based training itself (table 3):

1. The realism of the simulation is a limitation to assessment: “I will not ask to the patient if he is mottling” (EM 2), “it’s not the real life” (EM 5), “it’s difficult to pretend doing or seeing something that don’t exists” (EM 14).

2. Simulation-based assessment replaces practical skills in the center of the training, as SBT does too. For the students, it’s a complement to their clerkship: “we don’t do those procedures within clerkships” (PC 10), “it’s considered to be easy by our teachers, so they never show us” (PC 5), “everybody knows how to write down the process of endotracheal intubation, but that none of us know how to make it” (PC2), and “there is a lot of “simple things that we are supposed to control, but in fact, it’s not the case” (EM 16).

Discussion

Our study explored the original and unanswered question of students’ perceptions of validation and assessment with simulation and it underlined some issues regarding the conditions and development of simulation-based assessment, with focus on the benefit for their hospital clerkships and on the advantage of a high-quality assessment to highlight the practical skills throughout their curriculum. However in some conditions they also found it was a biased and flawed assessment system that didn’t prepare them for the high stakes assessments of their curriculum. They described a change in the way
they prepared for and approached the simulation based courses. Following the grounded theory methodology, we can formulate some hypothesis after analyzing students’ simulation-based assessment perceptions.

Students stressed out the teaching and assessment requirements within their clinical rotations although it wasn’t mentioned in our interviews. The subject was always discussed in comparison and opposition to traditional teaching and assessing in medical school. First they found a real benefit from being certified with simulation-based assessment. Not only because it helped them with unusual assessed competencies but also because it helped them with self-confidence when facing hospital teams and also re-assured them to manage new clinical situations. It highlighted an important fact: medical students evolve in a dual system, between university and hospital. They consider university as a uniformed system, unbiased for teaching and assessment in opposition to hospital clerkships where a large heterogeneity in the teaching and assessing methods is reported. We can understand this configuration thanks to the Engerström activity theory (24). Two systems have the same objects (medical education), but not the same final objective nor the same rules or work division to work with. The main objectives of hospitals are the patient outcomes although medicine faculty’s objectives are MS learning and certification. A contradiction exists between the two systems, because of these different objectives. SBT and assessment could create the link between the two of them as suggested by Berragan et al (25).

Another change induced by simulation-based assessment was the different way to prepare for the whole simulation-based courses. The willingness to endorse the simulation-based course because of the final assessment was new and could help them change their learning practices. With this assessment, students knew the aim of the courses, they could prepare for it and they had certain autonomy to do so. Autonomy, motivation and control in learning are factors who provide students self-regulated learning and encourage them to be actors of their learning (26). They have intrinsic motivation to succeed, and this is associated with deepen learning, and increased control of own students’ outcomes, which could decreased feelings of distress (27).

When the students identified simulation-based assessment as an unfair assessment, they mentioned the subjectivity and lack of authenticity of the exercise. However, subjectivity is one of the inherent pitfalls of a competency-based assessment (28). The nature of a competency is a multicomponent object, with exteriorized and measurable one (the performance) but also with hidden component like mobilization of internal resources or clinical reasoning. Our hypothesis is that medical students rejected the subjectivity because it is not aligned with their “students’ culture” (29). Indeed, for the past decades, a quality assessment was defined as quantitative and objective. The challenges for the faculty is to understand this subjectivity and to deal with it, in order to make new frameworks of assessment, different from MCQ (3). To accept that subjectivity is a part of the competencies will help educators and students to adopt quality’s assessments, like multimodal ones with several tools and situations in a whole programmatic assessment (30). For that, simulation has a great role to play, because it employs controlled environments, reproducible, reliable, with a part of subjectivity that can be controlled.
Discussions on the practical aspects of the simulation-based assessment highlighted two major characteristics of such an assessment: feedback and rating. Normative assessment usually doesn’t provide feedback, only grades and classifications. Simulation-based assessment could provide it all, and give students insurance in their skills. Grades were not completely approved by our students. They preferred knowing they had the skills instead of being classified (31). Some authors also found these results, with a specific element: the more they progressed in the curriculum, the more they felt demotivation for graduations (32). Grades engage extrinsic motivation, which is linked to short term memory, surface learning, unlike intrinsic motivation which helps self-development, satisfaction of the accomplished task and increased efficacy (27). One other suggestion of our results is the ethical issue of our assessment. As previously shown, debriefing is an essential part of simulation-based training (33,34). During the assessment sessions, debriefing was shorter than during the training sessions. However, it was appreciated by the students, because it was the first time they were provided individual feedback immediately after an assessment. However, for simulations practice, it could be viewed as a short, weak debriefing and could participate to the unfair perception of simulation-based assessment. A possible improvement would be to give each student a personal feedback, with individual improvement axes (35).

Another ethical concern is the stress linked to the assessment process. Simulation-based training, is supposed to be a safe environment, to learn with the possibilities to make errors, and learn from these. It has been shown to be a stressful environment (36). If we add stress to assessment, it could deflect SBT from one of his important aims: the safe learning.

For these different reasons caution should be applied to simulation-based assessment for medical students and we should improve our simulation tools and environments.

**Limits**

This study presents some limitations. First, it’s a single-center study but with two different simulation-based assessment and many hospital clinical rotation from which students didn’t have the same experiences. Second, we couldn’t question teachers although it was initially part of our project. They refused to participate to focus groups or individuals interviews, except for informal ones. They deplored the lack of time to participate. Finally, to analyze the two activity systems, we should have conducted observations at the hospital, and interviews with other actors from the medical students training, such as the senior lecturers, the residents and the medical school teachers.

**Conclusion**

This innovative and original research explores medical students’ perception of simulation-based assessment. Our results highlight many positive aspects, as the students found a high quality assessment, providing confidence for their clerkship and improvement for their clinical reasoning and apprenticeship. However students also found it unfair, stressful and useless for their final written
assessment, these results are inspiring and should lead to the improvement and development of simulation-based assessment, programs throughout the medical students’ curricula.

List Of Abbreviations

CBME: competency-based medical education

EM-ICMC: emergency and intensive care medicine curriculum

EM1: student one from EM-ICMC

PC: paediatric curriculum

PC1: student one from PC

SBA: Simulation-based assessment

SBT: Simulation-based training

SRLF: French Society of Intensive Care Medicine

Declarations

*Ethics approval and consent to participate:* as reported in the manuscript, ethical of the SRLF approved the study protocol and students signed an informed consent.

*Consent for publication:* not applicable

*Availability of data and materials:* data supporting the results are available in a safety and secured electronic file, in the ALP professional computer. All the transcripts are available if needed. So data are available from the corresponding author on reasonable request.

*Competing interests:* the authors declare that they have no competing interests.

*Fundings:* the authors declare that they had no funding for this study.

*Authors’ contributions:* all authors have made contributions: ALP, AP, MCR, GLB and YF designed the work. ALP made the interviews and constructed the semi-directed interviews with the help of JT, YF, and GLB. ALP and JT made the analysis and interpretation of data. ALP wrote the draft and YF, JT, NdS et AP substantively revised it. All the authors have approved the submitted version and any substantially modified version that involves the author’s contribution to the study. They all have agreed both to be personally accountable for the author’s own contributions and to ensure that questions related to the accuracy or integrity of any part of the work.
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**Tables**

Due to technical limitations the Tables are available as a download in the Supplementary Files.

**Supplementary Files**

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- Appendix1.docx
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