

# How can we characterize medical simulation environment as a specific type of medical environment?

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## Research article

**Keywords:** medical simulation, educational environment, DREEM scale, medical simulation environment, adaptation

**Posted Date:** April 22nd, 2020

**DOI:** <https://doi.org/10.21203/rs.3.rs-23649/v1>

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# Abstract

**Background:** In order to improve the quality of courses in simulation, it is necessary to get to know the educational environment. The objective of this study was to adapt the DREEM scale and to present a new questionnaire called QuESST, that allows to define medical simulation environment as a specific type of educational environment.

**Methods:** The DREEM scale was translated and adapted into Polish conditions. A new tool – QuESST questionnaire was developed to complete the data with medical simulation environment aspects. Reliability, t-test, Component Analysis as well as correlation between the two methods were assessed in a sample of medical science students (N=312).

**Results:** Statistical analysis presented a good reliability of the Polish translation of the DREEM scale (Cronbach's Alpha = 0,95). The t-test for the DREEM questionnaire was stable and reliable relevant ( $t=-,584$ ,  $p=,562$ ). Significant strong correlation was reported with the DREEM and QuESST tool ( $r=0,559$ ,  $p£ 0.001$ ). Also, moderate and high correlations were found with the overall result of QuESST and the results of individual DREEM subscales.

**Conclusions:** The QuESST scale may be considered helpful in determining the medical simulation environment conditions and can be used to supplement the DREEM scale to create an effective educational environment with medical simulation.

## Background

Ensuring an effective educational environment has become an important aspect of planning high quality education service. When medical education is taken into consideration, the teaching process itself should meet specific requirements, including provision of an appropriate learning environment to optimize the learning process (1). With simulation methods introduced to enhance education of medical trainees in a setting resembling real clinical conditions, apart from general educational environment, identification of some special traits of an effective simulation environment should be given priority. Students' perception of this environment will be an important determinant affecting the effectiveness of the learning (2).

Many authors have already been interested in studying the influence of the educational environment on the learning process and a few scales have been developed, for example, the DREEM scale, the JHLES scale, the MSLES scale and others (3–21). The comparison of these tools is shown in Table 1.

The purpose of our study was to adapt a method investigating general aspects of educational environment and to design a new tool, which would enable description of students' opinion about medical simulation environment. We assumed that there is a need for using two scales that would be complementary to successfully analyze the characteristics of an effective environment used to educate medical students.

For the basis of our study we have chosen to adapt the DREEM scale because it enables to examine the educational environment with high reliability, accuracy and can be used to collect data from medical students, nurses, dentists and other medical professionals. It can be used to compare medical schools in terms of existing conditions of the educational environment, as well as aspects of individual courses (22).

Since no other tool has been found that could be used to identify the characteristics of simulation environment allowing to recognize it as a specific setting of the learning process, a proprietary Questionnaire for Evaluation of Satisfaction with Simulation Training (QuESST) method was designed. It describes distinct aspects that may influence organization of the educational environment, for example, the infrastructure and equipment, students' attitude towards simulation classes, students' opinions on the strengths and weaknesses of the simulation.

The paper presents mutual correlations between the overall result of the QuESST scale and the overall result along with the results of individual subscales of the DREEM tool. The efforts undertaken in this study to develop the QuESST tool should be continued to further strengthen the psychometric values of the tool.

## Methods

### ADAPTATION OF THE DREEM SCALE

The Educational Environment Assessment Method (DREEM) was designed by Roff and co-authors (22) as a tool to identify general aspects of the educational environment (20). The scale is not sensitive to cultural differences and can be widely used in medical and health care institutions. It consists of 50 items referring thematically to the educational environment, grouped in 5 subscales:

- I. Students' perception of the learning process
- II. Students' perception of teachers
- III. Self-perception in the academic environment
- IV. The perception of the atmosphere by students
- V. Self-perception in society

The DREEM scale enables to capture students' perception of learning, teachers, atmosphere as well as students' academic and social self-perception (3, 4, 6-8). Although it is very attractive psychometrically, it does not address the conditions of medical simulation as specific teaching conditions.

The DREEM scale has a few other limitations. As some authors indicate (23), routine evaluation analyses may not have a good statistical background, which may lead to confusion and misinterpretation. Also obtained data may be difficult to interpret and compare when collected at different institutions due to the lack of a standardized way to analyze and report DREEM (20).

In the first stage of the adaptation process of the DREEM scale, the authors of the scale were asked for and approved the possibility to use and modify the tool. We obtained the original version of the questionnaire along with suggestions that proved useful for making necessary statistical calculations. The scale was translated from the English language into Polish by two independent translators. After the summary of the translations in a form of a table, they were evaluated by 10 competent English-speaking referees with the minimum level of language qualifications being C1. The evaluation addressed the question: Which translation is closer in meaning to the original? We summarized the assessments made by competent judges and selected translations for each claim individually according to the frequency of choice. Finally accepted translations were the ones that were chosen most frequently by the judges. In this way, we created a draft version of the DREEM method in the Polish language. Our next step was a retranslation of the scale from the Polish language into English by an independent translator. After the retranslation a competent judge fluent in English compared the two English versions of the scale: the original English version and the return translation from Polish. The assessment was made with a scale of 0-1 asking whether the translation of the method is consistent with the original version or not. Our last step was the summary of the adaptation process by including the statements which on the 0-1 scale achieved the value of 1 and improving the statements which achieved the value of 0. The final version of the adapted DREEM tool was aimed to resemble the original both in graphic and content-related terms. In order to determine the psychometric properties of the Polish translation of DREEM subscales we conducted two pilot studies. The first involved 50 people tested twice (test and retest); the second study was conducted after a one-month break. The results of the studies' analyses are presented in Table 2.

## CONSTRUCTION OF THE QUESTIONNAIRE FOR EVALUATION OF SATISFACTION WITH SIMULATION TRAINING (QuESST)

The Questionnaire for Evaluation of Satisfaction with Simulation Training (QuESST) addresses the aspects related to simulation experience and organization of the simulation environment as an educational environment. The questionnaire takes into account, among others, the content related to the attitude, involvement and preparation of academic teachers for simulation classes, organization of the classes and the level of realism. Students may also assess the level of their involvement in simulation classes, the extent to which the classes give them opportunity to learn practical skills and improve their communication skills. The QuESST questionnaire therefore takes into account a wide spectrum of the organization of simulation classes, as well as their content with reference to evaluation of the performance of academic teachers and self-evaluation made by students.

The QuESST questionnaire consists of 20 statements describing the simulation environment as a specific learning environment for students. The statements included in the tool were constructed on the basis of the authors' observations and experience, as well as interviews with students of medical sciences (n=312). Respondents provided answers using a 5-point Likert scale, where the values of this scale corresponded to the statements: I completely agree (5), I agree (4), I have no opinion (3), I do not agree (2), and I completely disagree (1). In order to determine the reliability of the constructed QuESST method, the Alfa Cronbach's coefficient was calculated. In order to determine the internal structure, the

loads of particular items were analyzed using Component Analysis. Standardization of this method was calculated based on quartiles.

## Results

The value of the Alfa Cronbach's coefficient for the original DREEM questionnaire is  $\alpha = 0,91$  (22), while the value of the Alfa Cronbach's coefficient for the Polish translation of DREEM questionnaire is  $\alpha = 0,95$ , which indicates a good reliability of the translation. The value of the t-test (test-retest) for the DREEM questionnaire shows no statistical significance, which means that the result is internally relevant (Table 2).

The above psychometric values confirm the adaptation of the questionnaire according to the research methodology.

In order to determine the reliability of the constructed QuESST method, the Alfa Cronbach's coefficient was calculated. The reliability of the scale for 20 items was  $\alpha = 0.865$ . The Component Analysis was conducted to determine the internal structure. It was assumed that the items would be included in the structure of the method if the value of the load was above or equal to 0.30 (Table 3). There were four items removed, as they did not meet this criterion. For this reason, the method was re-examined for reliability. The Alpha Cronbach value after deletion of the four items was  $\alpha = 0,91$ .

The correlations between the overall score of the QuESST questionnaire, the overall score and the scores of individual subscales of the DREEM tool are presented in Table 4.

The results indicate that obtained correlations are at the level of significance equal to  $p \leq 0.001$ .

The overall score of the QuESST questionnaire correlates moderately with the following DREEM subscales: Perception of teachers scale ( $r = 0.433$ ), Academic self-perception ( $r = 0.420$ ), Social self-perception ( $r = 0.443$ ). The overall score of the QuESST questionnaire correlated strongly with the: overall score of the DREEM method ( $r = 0.559$ ) and with the following DREEM subscales: the Perception of the learning process scale ( $r = 0.544$ ) and the Perception of the atmosphere scale ( $r = 0.544$ ).

## Discussion

The adaptation process of the DREEM scale was conducted according to the research methodology. Alpha Cronbach's coefficient indicates good internal reliability ( $\alpha = 0,95$ ). The reliability for the QuESST scale is  $\alpha = 0,91$  after deletion of 4 items. The correlations of QuESST and DREEM general scores as well as the scores of individual subscales are at the level of significance equal to  $p \leq 0.001$ .

Organization of the educational environment is an important factor influencing the level of realization of particular educational goals. Medical simulation is a special kind of educational environment. Due to legislative changes imposing implementation of educational standards in medical degrees, it has

become a popular and necessary method used in program curricula. Medical simulation, defined as simulated clinical conditions, when optimally used, brings a great educational potential. The full use of its resources relies, among others, on the attitude of students to use simulation methods. In this study, therefore, an attempt has been made to present specific tools which may be helpful in investigating the perspectives of students with reference to conditions associated with implementation of a medical program curriculum using simulated environment (24).

Medical simulation is certainly a specific educational environment, which should meet specific requirements in order for educational activities to produce expected results. A few researchers have already attempted to define the role of simulation in medical education (25, 26). For example, Reynolds et al. (2008) presented a research aimed at assessing the impact of medical simulation-based teaching on students' knowledge and satisfaction with the teaching process. Their research was based on the course of Obstetrics and Gynaecology and provided results indicating that classes using medical simulation increase students' satisfaction with the teaching process (27).

Undoubtedly, one of the biggest assets of setting the learning process in simulation environment is the possibility to avoid risking patient's safety during simulated training. Students have the ability to undertake activities and procedures in a repetitive manner, being able to make and learn from mistakes, without any serious consequences. At the same time, simulation environment is a reflection of the conditions that are most likely found at any contemporary healthcare institution. Healthcare professionals are required not only to possess specific knowledge about medical procedures and related technical skills but also develop non-technical skills, decision-making skills, be able to work in a team, or communicate with patients of different ages and needs (28). Students are provided with an opportunity to practice and acquire these skills attending the courses organized in medical simulation environment, which makes them better prepared for their future work.

Very interesting correlations were obtained by using a correlation analysis between the overall result of the QuESST questionnaire and the overall result and the individual subscales of the DREEM questionnaire. Both the overall results of the QuESST and DREEM tools, as well as the overall result of QuESST and the results of individual DREEM subscales significantly correlated statistically. These correlations mean that the increase in the overall score of the QuESST questionnaire was linked to the increase in the overall score and the results of the individual subscales of the DREEM questionnaire. The assessment of the educational environment was therefore related to the assessment of simulation conditions made by students, in particular, their satisfaction with the simulation experience. The QuESST method seemed to confirm this relationship in a good way. High correlations between the proprietary QuESST tool and the existing DREEM tool may suggest a high psychometric value of the QuESST questionnaire.

Possibility to describe educational environment seems to be very important. Information about the aspects making educational environment a well-organized teaching and learning place can be further used in planning an effective educational environment based on simulated conditions. Simulation

environment requires appropriate preparation of teaching conditions, appropriate embedding in the curriculum and organization from the administrative point of view, high level of content, appropriate attitude of persons presenting the teaching content, ability to interact with students, ability to design scenarios and course of classes (29). Even a small inconvenience on the part of technical equipment may disturb the course of simulation classes and their realism.

Proper design and construction of the educational environment seems to be important from the perspective of optimization of the learning and teaching process. It is a kind of basis for the development of conditions in which learning will be organized using simulation methods (1, 30, 31) especially in medical faculties, where students often have to face real-life situations in a hospital or clinic. Using the DREEM tool seems to be essential for proper assessment of the educational environment. Additionally, it was necessary to construct another appropriate tool in order to capture specific conditions of simulation environment as an educational environment. The QuESST questionnaire proved to effectively identify distinct aspects related to educational process using medical simulation. Only a proper design of this process allows realization of the teaching content and successful achievement of the assumed educational goals.

Notwithstanding the effects of the QuESST tool designed in our study, it is recommended that further work on strengthening its construction and psychometric values is undertaken.

## Conclusions

The presented work shows the DREEM adaptation procedure for Polish conditions and the construction of the QuESST questionnaire that embraces the conditions of medical simulation as a specific educational environment. The DREEM tool is a well-standardized method and the actions undertaken in this work were aimed at testing this method in the simulation environment in Poland.

Poland is a country of 38 million people, where many doctors and specialists receive high-level medical education and then migrate to other countries to pursue their professional careers. Since 2012, steps have been taken at the national level to improve the system of medical education. Implementation of new standards required simultaneous development and improvement of both conceptual and practical issues related to teaching medicine. Many procedures needed to be supplemented in different medical education areas (32). The educational profile of medical studies has been largely focused on practical aspects and standardization of the teaching and learning process.

A well-organized general educational environment is the first step for specific organization of education in simulated conditions. For this reason, our goal was to prepare tools that would help to investigate educational environment, with particular emphasis on simulation environment, and identify the aspects, which make it an effective learning and teaching site.

The DREEM scale is a well standardized tool, used in many countries and is referred to in subject related literature. It clearly refers to 5 dimensions related to the educational environment, however, does not

address the specific simulation conditions; so widely-used in contemporary medical education. Nevertheless, the DREEM questionnaire was the basis for us to undertake work related to the construction of a specific QuESST tool. Thanks to the reference to the DREEM questionnaire, this QuESST has a good external relevance and seems to meet the needs that emerged in response to legislative changes in medical education in Poland. In our opinion, these two scales are complementary to successfully analyze the characteristics of an effective environment used to educate medical students. The study constitutes the basis for further development of learning conditions using simulation methods (1, 30, 31).

## **Limitations And Further Directions**

In this article we described the stage of initial work on adaptation and construction of tools. In the next stages it will be necessary to introduce the Polish translation of DREEM scale into a wider simulation environment, taking into account several medical simulation centers in Poland as well as strengthening the construction and psychometric values of the QuESST questionnaire.

## **Abbreviations**

DREEM The Educational Environment Assessment Method

QuESST Questionnaire for Evaluation of Satisfaction with Simulation Training

## **Declarations**

### **ETHICS APPROVAL AND CONSENT TO PARTICIPATE**

This study was approved by the Medical University in Lublin

Respondents were informed that participation in the study is considered as granting consent to the study

Written informed consent was obtained from the students for publication of this survey.

### **CONSENT FOR PUBLICATION**

Not applicable

### **AVAILABILITY OF DATA AND MATERIALS**

The datasets during and/or analyzed during the current study are available from the corresponding author on reasonable request.

### **COMPETING INTERESTS**

The authors declare that they have no competing interests



## FUNDING

The authors received no financial support for the research, authorship, and/or publication of this article.

## AUTHORS' CONTRIBUTIONS

KT have made substantial contributions to the conception and designing the work; PM contributed to the analysis of the data; IM contributed in the interpretation of the data and preparation the introduction; AT substantively revised the work

## ACKNOWLEDGEMENTS

Not Applicable

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## Tables

Table 1. DREEM, JHLES, MSLES

	DREEM	JHLES	MSLES
<b>PURPOSE</b>	measuring the educational environment specifically for medical schools and other health professions	assessing students' perceptions of the medical school learning environment	planning appropriate interventions in the educational program, to assess their impact
<b>SPECIFIC USE</b>	to diagnose deficiencies in the current educational environment, to compare different groups' experiences with the educational environment to compare actual experiences of the educational environment with an ideal/expected in the same group to examine the relationship between the educational environment and other measures	to develop a new measure of students' perceptions of the LE that would capture the richness and variety of each student's relational, academic, and institutional engagement in medical school	-
<b>YEAR OF DEVELOPMENT</b>	2000/2002	2011, final publication 2015	1978
<b>DEVELOPED BY...</b>	panel of faculty members from international medical schools/health professions	Johns Hopkins University School of Medicine	Chicago Medical School
<b>VALIDATION GROUP</b>	tested on students in several countries	Of 465 students surveyed, 377 (81%) completed all LE items - to develop the scale	93 students to develop the scale
<b>ITEMS</b>	50	28	50 1/3 of items new 1/3 of items adapted from

			LEQ 1/3 of items adapted from other instruments
<b>SCALES</b>	Students' perception of learning (12 items); Students' perceptions of teachers (11 items); Students' academic self-perceptions (8 items); Students' perceptions of atmosphere (12 items) and Students' social self-perceptions (7 items)	Community of peers; Faculty relationships; Academic climate; Meaningful engagement; Mentoring; Inclusion and safety Physical space	7 (four of them were adapted from Learning Environment Questionnaire)  - Breadth of interest  - Student interactions  - Organization  - Flexibility  - Meaningful Learning Experience  - Emotional Climate  - Nurturance
<b>TRANSLATIONS/THE USE OF....</b>	translated into 8 languages and used in at least 20 countries	-	-
<b>CONSIDERING THE RESULTS:</b>	at three levels: (i) individual items, (ii) subscales and (iii) overall DREEM	the content of the JHLES describes social, relational, and academic processes of medical school that support students' professional formation	- Yield general knowledge  - Input in a decision

			making process
<b>LIMITATIONS</b>	many items	the items included in the JHLES may not be generalizable to other medical schools	-
<b>ADDITIONAL INFO</b>	DREEM has recently been recommended as the most suitable tool for this purpose for evaluation the educational environment in undergraduate medical education institutions	-	-

Table 2. Internal accuracy of the DREEM scale. Test-retest analysis

	M	sd	M	sd	t	p
DREEM	130,54	27,11	133,32	25,30	-,584	,562

Table 3. Items factorial load

Item	Compound	Item	Compound
1	,800	11	,537
2	,694	12	,520
3	,085	13	,754
4	,662	14	,276
5	,783	15	,377
6	,717	16	,714
7	,573	17	,656
8	-,217	18	-,343
9	,744	19	,647
10	,665	20	,804

Table 4. Correlations between the overall result of the QuESST and the overall result and individual subscales results of the DREEM tool

	QuESST GS
DREEM GS	,559***
Perception of the learning process	,544***
Perception of teachers	,433***
Self-perception in the academic environment	,420***
Perception of the atmosphere	,544***
Self-perception in society	,443***

\*  $P \leq 0.05$ ; \*\*  $P \leq 0.01$ ; \*\*\*  $P \leq 0.001$

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [QUESSTmethod.docx](#)