

Evaluation of a Polish Version of the Dundee Ready Education Environment Measure

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Abstract: **Introduction:** The Dundee Ready Education Environment Measure (DREEM) is an instrument that assesses the educational environment.

Aim: The aim of this study was to psychometrically evaluate a Polish version of the DREEM instrument.

Material and Methods: 203 medical students who fully completed the DREEM questionnaire were included in the study. Validity was evaluated through the analysis of construct validity and reliability.

Results: After language validation the internal consistency was assessed. Cronbach's alpha for the overall score was 0.93 and the five subscales were: perceptions of learning 0.86, perceptions of teachers 0.82, perceptions of atmosphere 0.75, academic self-perceptions 0.61, and social-self perceptions 0.61. The exploratory factor analyses, however, yielded dimensions that did not fully correspond to the original DREEM subscales.

Conclusions: Internal consistency of the Polish version of the DREEM scale as a whole was excellent, however for each of five originally developed subscales it was lower and vary a lot; construct validity of Polish version was not compatible with the original structure of the DREEM scale but was reasonable. A new five-factor solution obtained in this study could be a reliable tool for assessing the medical education environment in the Polish circumstances, but it will require confirmation in future study.

Keywords: DREEM, educational environment, validity, reliability.

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Introduction

The educational environment encompasses educational, physical, social and psychological contexts in which students are learn and develop [1, 2]. There is an evidence that the educational environment has a crucial role in enhancing competency, critical thinking, independence, sense of mental wellbeing and self-confidence [3–8]. Also, it affects the student's level of academic achievement and degree of learning effectiveness [3, 8]. For these reasons, the educational environment is recognized as an important indicator for the quality of an academic curriculum [3, 7, 8]. Estimation of the educational environment may help to assess whether the learning process is running effectively according to the goals of learning [7–10].

The Dundee Ready Education Environment Measure (DREEM) was designed by Roff, McAleer, Harden, AlQahtani, Ahmed, Deza, Groenen and Primparyon (1997) [9] to measure the educational environment specifically for medical schools and other health professions [8]. It was developed using a Delphi method. The DREEM scale may assess the learning environment, solve educational problems, and improve the efficacy of education. The scale has been used in many universities worldwide, however, it is recommended that psychometric studies of DREEM be performed in other parts of the world to gain comprehensive information to review this instrument [8, 9]. This study aimed to examine construct validity and internal consistency of the Polish version of the DREEM scale.

Material and Methods

Study design and setting

The study was conducted at Jagiellonian University Medical College in Krakow, Poland, which offered a six-year, full-time undergraduate medical program. It was held in the middle of the winter semester in 2018–2019. The study was part of a larger project encompassing several scales to assess the educational environment and the student's motivation to work. Ethical approval to conduct the study was obtained from the Ethics Committee of Jagiellonian University.

Participants

The questionnaires were distributed among registered, active students (from all six years of study), during classes. Participation was voluntary, and the questionnaires were collected anonymously. The DREEM inventory was administrated to the students after obtaining written informed consent.

Study instrument and procedure

This study used a Polish translation of DREEM prepared by a native speaking Polish professional translator. Next, a back-translation by two independent, bilingual persons was carried out. The structured questionnaire had two parts: a) demographics, and b) DREEM inventory.

The DREEM scale contained 50 statements scored on a five-point Likert scale ranging from zero to four (4: strongly agree; 3: agree; 2: unsure; 1: disagree; 0: strongly disagree). However, 9 of the 50 items were negative statements and were scored in reverse. The 50 items had a maximum score of 200. The items were allocated to five subscales: students' perception of learning (SPL — 12 items/maximum score 48); students' perceptions of teachers (SPT — 11 items/maximum score 44); students' academic self-perceptions (SASP — 8 items/maximum score 32); students' perceptions of atmosphere (SPA — 12 items/maximum score 48) and students' social self-perceptions (SSSP — 7 items/maximum score 28) [9]. The items can be analyzed on three levels: individually, pooled into five subscales and overall [8].

Data analysis

In this study, the data were analyzed using SPSS (Statistical Package for the Social Sciences) version 25 from PS IMAGO 5.1 PRO package.

First, the basic characteristics of the DREEM (means, standard deviations) were calculated.

Second, Cronbach's alpha coefficient was used to assess the internal consistency of the overall and original subscale's scores of the instrument, and a minimum coefficient alpha of 0.7 was used to indicate an adequate level of consistency. Cronbach's alpha >0.7 demonstrated that the individual items that constituted a test, the DREEM tool, in this case, correlated well with one another or with the test total.

Third, the exploratory factor analysis (EFA) with the Varimax rotation was performed. In the explorative factor analysis, both the Kaiser's criterion and a scree plot inspection were used to determine the number of factors to be extracted. The data was screened for factorability using the Kaiser-Meyer-Olkin test, the Bartlett's sphericity test and anti-image matrix correlations.

Results

Basic psychometric properties

There were 203 medical students who fully completed the DREEM questionnaire (93.5% response rate), with 112 females and 90 males (one person did not indicate gender).

The basic psychometric properties of the DREEM were conducted, the data are reported in Table 1.

Table 1. Basic psychometric properties.

Subscale	Mean	SD	Max	Min	Max theoretical
SPL	25.1	7.49	48	5	48
SASP	18.2	4.14	32	3	32
SPT	27.2	5.92	44	8	44
SSSP	16.6	3.89	27	2	28
SPA	29.6	5.77	48	11	48
Total score	116.7	22.91	199	57	200

Internal consistency

Cronbach's alpha value of 50 items of DREEM was 0.93 and for the five subscales were: perceptions of learning (SPL) 0.86, perceptions of teachers (SPT) 0.82, academic self-perceptions (SASP) 0.61, perceptions of atmosphere (SPA) 0.75, and social self-perceptions (SSSP) 0.61 (Table 2).

Table 2. Results for the overall DREEM score and the five subscale scores.

Subscale	Cronbach's alpha
SPL	0.86
SPT	0.82
SASP	0.61
SPA	0.75
SSSP	0.61
Total	0.93

In our study, Cronbach's alpha coefficient of the whole DREEM scale was found to have an excellent reliability score, but the two subscales (academic self-perceptions SASP, and social self-perceptions SSSP) had a lower internal consistency score (Cronbach's alpha = 0.61 in both cases).

Construct validity

The values of Kaiser-Meyer-Olkin test ($KMO = 0.878$) and Bartlett's sphericity test ($\chi^2(1225) = 4172,986$; $p < 0.001$) justified the use of the exploratory factor analysis. Only for one question, question 17. "Cheating is a problem in this school" the anti-image correlation matrix was below 0.5, but because we aimed to assess the DREEM scale as a whole, initially we didn't remove this from the calculations. According to the scree plot examination and the Kaiser criterion, a fifteen principal-component analysis with the 50 DREEM scale items was suggested to determine structure validity (Fig. 1). However, the exploratory factor analysis, with fifteen components, showed that in the majority, a single item of the DREEM scale created principal-components. That's why, finally a five-factor structure that could give a logical classification of the items, was taken.

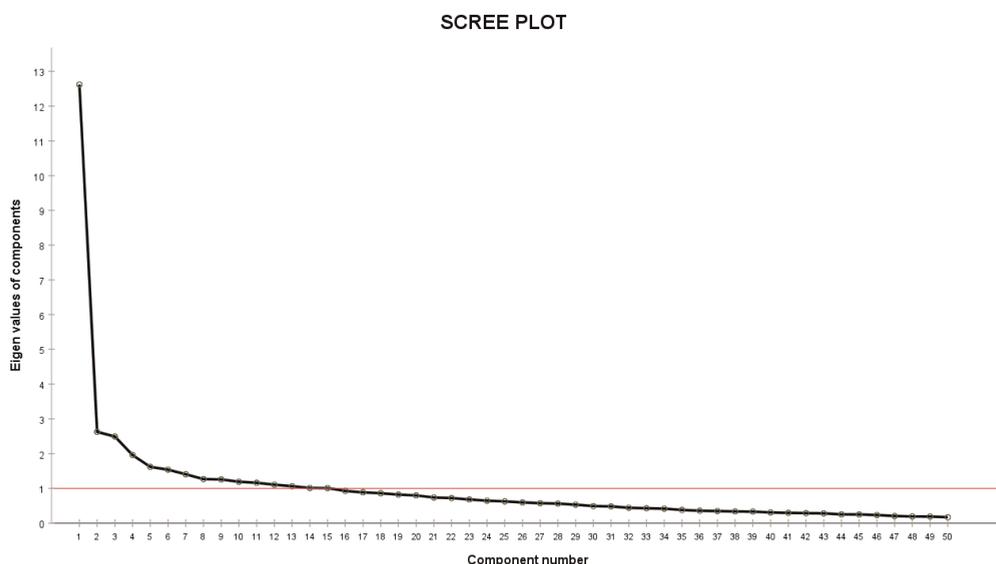


Fig. 1. Eigenvalues of DREEM — scree plot.

The results of EFA are presented in Table 3.

In the exploratory factor analysis, all of the items loaded onto factors F1 to F5 greater than 0.3. 18 items from all loaded onto two or more factors. The our five factors we interpreted in a meaningful way: factor 1 (F1) described the learning and personal student's development, factor 2 (F2) included the characteristic of the teachers, factor 3 (F3) described perception of the atmosphere and communication (with the exception of question number 46, this question we moved from factor 3 to factor 4;

Table 3. The original five subscales of the DREEM and EFA of our data set.

Item	Original DREEM subscales	Exploratory Factor Analysis (EFA)				
		F1	F2	F3	F4	F5
1	SPL	.613				
2	SPT	.397	.553	.308		
3	SSSP	.352				
4	SSSP	.388				.471
5	SASP					.625
6	SPT		.328	.347		
7	SPL	.659				
8	SPT		.657			
9	SPT		.585			
10	SASP					.648
11	SPA		.366	.396		
12	SPA	.571				
13	SPL	.703				
14	SSSP	.576				
15	SSSP				.688	
16	SPL	.693				
17	SPA		.402			
18	SPT	.441	.325	.365		
19	SSSP				.733	
20	SPL	.725				
21	SASP	.612				
22	SPL	.489				
23	SPA	.315				
24	SPL	.692				
25	SPL	.386	.309			
26	SASP	.449				
27	SASP	.309				.464
28	SSSP				.599	
29	SPT			.511		

Table 3. Cont.

30	SPA	.421		.373		
31	SASP			.501		
32	SPT	.351		.582		
33	SPA				.658	
34	SPA		.304	.456		
35	SPA	.514	.309			
36	SPA					.498
37	SPT	.324		.537		
38	SPL	.575				
39	SPT		.707			
40	SPT	.421	.489	.338		
41	SASP	.369		.368		
42	SPA	.531				
43	SPA	.671				
44	SPL	.555		.392		
45	SASP	.508		.308		
46	SSSP			.370	.319	
47	SPL	.338				
48	SPL	.340	.534			
49	SPA			.445		
50	SPT		.586			

*the loadings <0.3 have not been displayed

in the EFA, this item loaded onto both factors 3 and 4 greater than 0.3); factor 4 (F4) described the student's psychosocial situation and factor 5 (F5) indicated academic development. The comparison between the original structure of the DREEM scale and our results is shown in the Table 4.

Cronbach's alpha value of our 50 items of the DREEM was 0.93 and for the five subscales were: factor 1 (0.92), factor 2 (0.76), factor 3 (0.74), factor 4 (0.72), factor 5 (0.59).

We also decided to perform another exploratory factor analysis after rejecting one question indicated by the anti-image correlation matrix; question number 17. In this analysis, all of the items loaded onto factors F1 to F5 greater than 0.3. Compared with the first EFA, there were three differences applied to items number 6, 11, and 49. In

Table 4. Grouping of the 50 items according to the results of principal component analysis with Varimax rotation.

DREEM scale (5 subscales)		Exploratory factor analysis		Interpretation (Students' perceptions of)
Original DREEM subscales	Question number	Our factors	Question number	
Students' perception of learning	1, 7, 13, 16, 20, 22, 24, 25, 38, 44, 47, 48	1	1, 3, 7, 12, 13, 14, 16, 18, 20, 21, 22, 23, 24, 25, 26, 30, 35, 38, 41, 42, 43, 44, 45, 47	learning and personal development
Students' perceptions of teachers	2, 6, 8, 9, 18, 29, 32, 37, 39, 40, 50	2	2, 8, 9, 17, 39, 40, 48, 50	teachers
Students' perceptions of atmosphere	11, 12, 17, 23, 30, 33, 34, 35, 36, 42, 43, 49	3	6, 11, 29, 31, 32, 34, 37, 46, 49	atmosphere and communication
Students' social self-perceptions	3, 4, 14, 15, 19, 28, 46	4	15, 19, 28, 33	psychosocial situation
Students' academic self-perceptions	5, 10, 21, 26, 27, 31, 41, 45	5	4, 5, 10, 27, 36	academic development

the first EFA (with question number 17), the questions numbered 6 and 11 both loaded to factor 2 and 3 above 0.3, but stronger to factor 3. Item number 49 was loaded above 0.3 only to factor F3. In the second EFA (without question number 17), all the items (questions numbered 6, 11, and 49) loaded the strongest to factor 2 (Table 5). Cronbach's alpha value of our 49 items scale (without item number 17) was 0.93, and the five subscales were: factor 1 (0.92), factor 2 (0.8), factor 3 (0.66), factor 4 (0.72), factor 5 (0.59).

In the original DREEM scale question number 17 was part of the SPA subscale (Students' perceptions of atmosphere). In our statistical analysis it was loaded to factor 2, which described teachers and did not fit to this subscale. Meaningful we think, that question number 17 should have been removed, item number 6. "The teachers are patient with patients" should have belonged to factor 2 which described teachers, item number 11. "The atmosphere is relaxed during the ward teaching" and item number 49. "I feel able to ask the questions I want" fit better into subscale 3, which described atmosphere and communication.

Table 5. The original five subscales of the DREEM and EFA of our data after rejecting question 17.

Item	Original DREEM subscales	Exploratory Factor Analysis (EFA)				
		F1	F2	F3	F4	F5
1	SPL	.616				
2	SPT	.406	.602			
3	SSSP	.355				
4	SSSP	.386				.430
5	SASP					.650
6	SPT		.364	.305		
7	SPL	.663				
8	SPT		.668			
9	SPT		.627			
10	SASP					.667
11	SPA		.386	.353		
12	SPA	.555				
13	SPL	.702				
14	SSSP	.565				
15	SSSP				.656	
16	SPL	.689				
18	SPT	.461	.372			
19	SSSP				.755	
20	SPL	.728				
21	SASP	.620				
22	SPL	.508			.314	
23	SPA	.324	.322			
24	SPL	.692				
25	SPL	.385	.306			
26	SASP	.476				
27	SASP	.323				.375
28	SSSP				.606	
29	SPT	.314		.510		
30	SPA	.449		.323		
31	SASP			.494		

Table 5. Cont.

Item	Original DREEM subscales	Exploratory Factor Analysis (EFA)				
		F1	F2	F3	F4	F5
32	SPT	.391		.533		
33	SPA				.665	
34	SPA		.348	.421		
35	SPA	.504	.323			
36	SPA					.560
37	SPT	.365		.465		
38	SPL	.595				
39	SPT		.729			
40	SPT	.426	.531			
41	SASP	.398		.318		
42	SPA	.543				
43	SPA	.679				
44	SPL	.572		.340		
45	SASP	.523				
46	SSSP			.455		
47	SPL	.357		.302		
48	SPL	.331	.531			
49	SPA		.356	.325		
50	SPT		.571			

*the loadings <0.3 have not been displayed

Discussion

In this study, we assessed the validity and reliability of the Polish translation of the DREEM scale. Cronbach's alpha value of the total DREEM scale in our study was excellent, but the internal consistency of the five subscales were not very high. Three subscales (SPL, SPT and SPA) had good reliability scores (Cronbach's alpha above 0.7). In the remaining two subscales (SSSP and SASP), the internal consistency was not satisfactory. The comparison of our results with the results obtained by the other authors [5, 10–12, 14–16] from different countries indicated similarities. The proper value of Cronbach's alpha associated mostly with SPL, SPT and SPA subscales, the lowest with SSSP and SASP (Table 6).

Table 6. Comparison of internal consistency of different versions among countries.

Country	Total Cronbach's alpha	Subscales Cronbach's alpha
Our	0.93	SPL — 0.86, SPT — 0.82, SASP — 0.61, SPA — 0.75, SSSP- 0.61
Indonesia [10]	0.883	SSSP — 0.32, SASP — 0.594, the others >0.7
Chile [11]	0.91	SPL — 0.77, SPT — 0.75, SASP — 0.64, SPA — 0.69, SSSP- 0.59
USA [12]	0.93	SPL — 0.85, SPT — 0.79, SPA — 0.81, SASP — 0.68, SSSP — 0.72
Sweden [5]	—	Cronbach's alpha ranged from 0.6 to 0.84 over all the subscales, but data not reported for each subscale
Greece [14]	0.9	SPL — 0.79, SPT — 0.78, SASP — 0.69, SPA — 0.68, SSSP — 0.48
Ireland [15]	0.89	SPL — 0.78, SPT — 0.69, SASP — 0.74, SPA — 0.56, SSSP — 0.55
Pakistan [16]	0.89	SPL — 0.72, SPT — 0.73, SASP — 0.67, SPA — 0.64, SSSP — 0.38

The construct validity of our data based on the five-factor structure was not compatible with the original structure of the DREEM scale but was reasonable. Almost all of the items (except item number 48) which build the original subscale „Students' perception of learning” were part of our factor 1, which described the learning and personal student's development. In the other subscales, the items loaded somewhat different, but we received the subscales which described teachers, atmosphere, academic development and social situation; similar to the original ones (Table 4). We comprehensively searched published literature and found that the original subscales structure of the DREEM scale was not maintained in several translated versions [12, 14, 15, 17]. It was suggested that one of the reasons for this situation may have been due to the fact, that originals were largely arrived at by consensus of a qualitative group rather than by statistical method [14]. The other cause may have been ineffectively translated items, although the translation was proper, it failed to adjust for the cultural differences [14]. The authors suggested that it may need to be revised for the five-factor model proposed by the developers of the DREEM scale (e.g. Jakobsson *et al.* [17] proposed a new five-structure solution). Some authors speculated that the DREEM should be a four-factor [11] or even a one-factor [15] scale instrument. Moreover, results of some studies suggested that single or even several items should be removed from the original DREEM scale [7, 10]. In our study, the anti-image matrix correlations indicated that question number 17. “Cheating is a problem in this school” should be removed from further calculations. We found that in several articles describing the validation of the DREEM scale also mentioned some problems with interpretation of question 17 (e.g. low correlation and low factor loading for item number 17 and 46 in the article by Jakobsson *et al.* [17]); item number 17 was one of the several invalid items, removed from further analysis in the study of Leman [10].

Question 17, along with the questions number 9, 10, 22, 39, and 42 were removed from the questionnaire in the study conducted by Koohpayehzadeh *et al.* [7]. Also low loading in the EFA were question number 17 and questions number 4, 21, 25, 38 and 50 in the study by Dimolatis *et al.* [14]. Authors cited most often as a cause for removal of these questions from the questionnaire to be the differences in the cultural context of the countries.

Study limitation

The limitation of this study was its relatively small study group size.

Summarizing, the psychometric characteristics of the Polish adaptation of the DREEM was similar to those reported for other language versions. However, we also failed to maintain the original version of the DREEM scale. We think that, it can be assumed, that the reduction of dimensions to five subscales was acceptable. The new five-factor structure proposed by us, composed of 49 items (without question number 17) should be confirmed in the next study.

Conclusions

Internal consistency of the Polish version of the DREEM scale as a whole was excellent, however for each of five originally developed subscales it was lower and vary a lot; construct validity of Polish version was not compatible with the original structure of the DREEM scale but was reasonable. A new five-factor solution obtained in this study could be a reliable tool for assessing the medical education environment in the Polish circumstances, but it will require confirmation in future study.

Acknowledgements

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Conflict of interest

None declared.

Abbreviations

- EFA — exploratory factor analysis
- SASP — students' academic self-perceptions
- SPA — students' perceptions of atmosphere
- SPL — students' perception of learning
- SPT — students' perceptions of teachers
- SSSP — students' social self-perceptions

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