Can DREEM Instrument (Dundee Ready Education Environment Measure) measure the learning environment in a School of Education?

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ABSTRACT

The DREEM inventory is a validated tool assessing the educational environment in health professions institutions around the world. The aim of the present study was to validate DREEM in a different educational setting. The translated and validated in Greek questionnaire was delivered to the students of the Department of Educational Sciences and Early Childhood Education at the University of Patras. The explorative factor analysis revealed a different model than the one proposed in the original DREEM study. The overall 62% score showed a very good educational environment in the educational department. The lowest scores were related to the lack of an efficient stress-support system, lack of appropriate feedback from teachers, and to the fact that students are bored during the courses. Even though the instrument is a highly recommended tool for use in a medical school environment it seems that different aspects should be considered for different educational settings.

KEYWORDS

DREEM, validation, educational department, educational environment, undergraduate students

RÉSUMÉ

L'inventaire «DREEM» est un instrument validé au monde entier d'évaluation de l'environnement éducatif dans des établissements de professions médicales. Le but de la présente étude était de valider DREEM dans un cadre éducatif différent. Le questionnaire, traduit en grec et validé, a été remis aux étudiants du Département de Sciences de l'Education et de l'Education Préscolaire à l'Université de Patras. L'analyse factorielle exploratoire a révélé un modèle différent de celui proposé dans l'étude originale de DREEM. Le score global de 62% a montré un très bon

environnement éducatif dans le Département de l'Education. Les scores les plus faibles ont été liées à l'absence d'un système efficace de soutien aux situations stressantes, au manque de rétroaction appropriée des enseignants, et au fait que les élèves s'ennuient pendant les cours. Même si l'instrument est un outil fortement recommandé pour l'usage dans un environnement éducatif médical, il semble que différents aspects doivent être pris en considération pour différents contextes éducatifs.

MOTS-CLÉS
DREEM, validation, département de l'éducation, environnement éducatif, étudiants

INTRODUCTION

The improvement of the educational environment is a major goal for higher education institutions and different instruments have been utilised to investigate educational climate and influence the educational policy. In Health Sciences Education a universal diagnostic inventory named DREEM (Dundee Ready Education Environment Measure) has been developed using a combination of qualitative and quantitative techniques to assess the educational environment (Roff et al., 1997). DREEM inventory has been administered for more than fifteen years in health professions education for a variety of purposes including indentifying strengths and weaknesses in curriculum, assessing the impact of new interventions and curriculum reforms, predicting students' academic achievement, comparing students' perceptions of the education environments within and between different institutions or between cohorts within an institution (Roff, 2005).

DREEM includes 50 items, 41 positively worded and nine negative, relating to students' perceptions of learning (12 items), perceptions of teachers (11 items), academic self-perceptions (eight items), perceptions of atmosphere (12 items), and social self-perceptions (seven items) (Roff, 2005). Each item is scored in a five-point Likert-type scale (from 0-strongly disagree to 5-strongly agree), except for the nine negatively worded statements which are scored in reverse. The maximum score of 200 (50 answers x 4) indicates the ideal educational environment as perceived by the students.

Since 1997, this instrument has been translated in many languages and used in several health sciences' educational settings (Medicine, Dentistry, Chiropractic) around the world (Roff, 2005; Kossioni et al., 2011), by it has never been applied in other disciplines. The instrument has been previously translated in the Greek language and validated in Greek medical (Dimoliatis, 2010; Dimoliatis et al., 2010) and dental schools (Kossioni et al., 2011).

As there aren't any other related instruments validated in educational departments in Greece and the assessment process is a key to the delivery of a high quality academic curriculum, the aim of the present study was to investigate whether DREEM can measure the educational environment in an educational discipline, in order to improve the educational curriculum of the School.

METHODOLOGICAL FRAMEWORK

The DREEM questionnaire was delivered at the Department of Educational Sciences and Early Childhood Education (DESECE) at the University of Patras in Greece. The DESECE is one of the oldest schools of educational studies in early childhood education in Greece. DESECE has

always been concerned with conducting research to promote the sciences of education and providing its graduates with a high-level scientific knowledge and practical skills for succeeding in their profession. The studies endure four years and the students have also to succeed in their practical training. The practical training is carried out in kindergartens in combination with predetermined number of laboratorial hours at the Department. The students, during their practical training in Kindergartens, are in contact with children and have to plan and implement activities or daily lessons for the children. The attendance in the practical training is compulsory for the students' completion of studies and the acquisition of their degree. After the acquisition of the degree they may pursue a professional career as Kindergarten teachers.

Based on the previous Greek translation and validation studies (Dimoliatis et al., 2010; Kossioni et al., 2011) we proceeded to minor further modifications to better address the curriculum of the educational Department. For example, the undergraduate pedagogical education includes practical training with children in schools instead of working with patients. The modified questionnaire is presented in Table 1. The statement number 6 "The teachers are patient with patients" was changed to "The teachers of the practical training group are patient with children", the statement number 11 "The atmosphere is relaxed in the clinics" was changed to "The atmosphere is relaxed during the practical training in schools", the statement number 18 "The teachers have good communication skills with patients" was changed to "The teachers of the practical training group have good communication skills with children", and the statement number 45 "Much of what I have to learn seems relevant to a career in healthcare" was changed to "Much of what I have to learn seems relevant to a career as an early childhood teacher".

TABLE 1

The originally administered questionnaire

(1) I am encouraged to participate in class
(2) The teachers are knowledgeable
(3) There is a good support system for students who get stressed
(4) I am too tired to enjoy the course
(5) Learning strategies which worked for me before continue to work for me now
(6) The teachers of the practical training group are patient with children
(7) The teaching is often simulating
(8) The teachers ridicule the students
(9) The teachers are authoritarian
(10) I am confident about my passing this year
(11) The atmosphere is relaxed during the practical training
(12) This Department is well time-tabled
(13) The teaching is student centred
(14) I am rarely bored on courses
(15) I have good friends in this Department
(16) The teaching is sufficiently concerned to develop my competence
(17) Cheating is a problem in this Department
(18) The teachers of the practical training group have good communication skills with children
(19) My social life is good
(20) The teaching is well focused
(21) I feel I am being well prepared for my profession
(22) The teaching is sufficiently concerned to develop my confidence
(23) The atmosphere is relaxed during lectures
(24) The teaching time is put to good use
(25) The teaching overemphasises factual learning

(26) Last year's work has been a good preparation for this year's work
(27) I am able to memorise all I need
(28) I seldom feel lonely
(29) The teachers are good at providing feedback to students
(30) There are opportunities for me to develop skills in interpersonal relationships with children
(31) I have learned a lot about empathy in my profession
(32) The teachers provide constructive criticism here
(33) I feel comfortable in class socially
(34) The atmosphere is relaxed during seminars/tutorials
(35) I find the experience disappointing
(36) I am able to concentrate well
(37) The teachers give clear examples
(38) I am clear about the learning objectives of the courses
(39) The teachers get angry in class
(40) The teachers are well prepared for their classes
(41) My problem-solving skills are being well developed here
(42) The enjoyment outweighs the stress of the courses
(43) The atmosphere motivates me as a learner
(44) The teaching encourages me to be an active learner
(45) Much of what I have to learn seems relevant to a career as an early childhood teacher
(46) My accommodation is pleasant
(47) Long-term learning emphasises over short term
(48) The teaching is to teacher-centred
(49) I feel able to ask the questions I want
(50) The students irritate the teachers

A pilot study was then conducted in 20 students in order to identify any problems in understanding the meaning of the items. The statements were scored from 0 to 5 as follows: 0: strongly disagree, 1: disagree, 2: slightly disagree, 3: slightly agree, 4: agree, 5: strongly agree, except for the nine negative statements (4, 8, 9, 17, 25, 35, 39, 48, 50) which were scored in reverse. As previously suggested (Dimoliatis et al., 2010; Kossioni et al., 2011) the middle option was split to 2: slightly disagree, and 3: slightly agree to prompt the students to answer all questions and prevent the central tendency bias (Dimoliatis et al., 2010). All scores were then transformed in a 1-100 scale.

The modified DREEM questionnaire was distributed to the 2nd- and 3rd-year students of the DESECE in the middle of the academic year (January). A total of 160 students with a mean age of 20.6 ± 1.2 years (range: 18-28 years) participated in the validation study (52% of the total 2nd- and 3rd-year students). The questionnaires were administered by a teacher during the course after explaining the purpose of the study. They were anonymously completed and collected at the same time.

Since the questionnaire was administered in a totally different group of students than originally targeted, a first selection of items was made from the descriptive response distribution for each question. The criteria used to guide item selection/deletion were high rates of non response (>20%) and ceiling and floor effects (>50%). In case that an item had more than half the answers in the "strongly agree" or "strongly disagree" categories, the subject expert had to agree if the item would remain or not in the questionnaire. Cronbach's alpha analysis was used to test the reliability of the resulting scales and decide which low-contributing items should be removed. Cronbach's α "if item deleted" were also calculated. An explorative factor analysis (EFA) using principal components analysis and varimax rotation was performed to identify the underlying clusters of items (subscales) in the questionnaire. The retained number of factors was identified

according to criteria previously defined by J. Schönrock-Adema and colleagues (2009). Descriptive statistics were used to calculate means, minimum and maximum values and standard deviations. T-tests were performed to identify any semester related variation. The level of statistical significance was set at p≤0.05. The data were statistically analysed using SPSS 19.0 (SPSS Inc., Chicago, IL, USA).

RESULTS

Of the 160 students that returned the questionnaire (response rate: 100%), 133 were women and 3 men, while 24 did not report their gender. Of the respondents, 69 attended the 2nd- and 91 the 3rd-year.

According to the criteria that was set for item selection it was found that items 8, 37, 46, 48 and 49 had a ceiling effect but it was decided by the expect committee to remain in the final analysis since they were significant items (Table 2).

TABLE 2
Descriptive statistics for all items, total score, original and new subscales' scores

	N	Minimum	Maximum	Mean	SD	beta	P value
Stat_01	160	0	100	62.0	24.5	.040	.000
Stat_02	160	0	100	78.0	17.1	.029	.000
Stat_03	158	0	100	31.5	23.3	.069	.000
Stat_04	158	0	100	47.9	26.4	.076	.000
Stat_05	156	0	100	58.3	24.7	.061	.000
Stat_06	158	0	100	74.9	19.4	.030	.000
Stat_07	159	0	100	61.9	20.7	.034	.000
Stat_08	160	20	100	70.1	19.9	.036	.000
Stat_09	156	0	100	67.6	19.5	.037	.000
Stat_10	160	0	100	63.9	21.5	.053	.000
Stat_11	159	0	100	69.9	20.7	.034	.000
Stat_12	160	0	100	49.0	26.3	.044	.000
Stat_13	159	0	100	59.6	19.5	.034	.000
Stat_14	159	0	100	38.9	22.5	.062	.000
Stat_15	156	0	100	75.4	23.8	.068	.000
Stat_16	156	0	100	65.6	20.5	.033	.000
Stat_17	158	0	100	60.0	21.8	.037	.000
Stat_18	158	0	100	72.3	18.3	.032	.000
Stat_19	159	0	100	81.1	18.5	.052	.000
Stat_20	158	0	100	64.6	21.3	.036	.000
Stat_21	159	0	100	64.0	20.8	.055	.000
Stat_22	158	0	100	60.1	22.2	.038	.000
Stat_23	159	0	100	66.7	19.8	.035	.000
Stat_24	160	0	100	63.8	19.6	.034	.000

Stat_25	160	0	100	46.5	25.1	.044	.000
Stat_26	159	0	100	52.5	23.0	.058	.000
Stat_27	160	0	100	46.3	23.2	.057	.000
Stat_28	158	0	100	64.1	26.3	.076	.000
Stat_29	159	0	100	34.1	23.3	.041	.000
Stat_30	159	0	100	60.4	22.9	.037	.000
Stat_31	159	0	100	68.7	20.3	.054	.000
Stat_32	158	0	100	50.5	22.8	.040	.000
Stat_33	160	0	100	67.6	20.4	.033	.000
Stat_34	159	0	100	73.3	18.2	.029	.000
Stat_35	158	0	100	70.4	23.1	.037	.000
Stat_36	159	0	100	58.7	21.4	.036	.000
Stat_37	158	40	100	69.1	15.1	.028	.000
Stat_38	159	0	100	65.2	22.2	.038	.000
Stat_39	160	0	100	59.4	21.8	.039	.000
Stat_40	160	0	100	71.9	17.1	.031	.000
Stat_41	159	0	100	54.0	21.6	.055	.000
Stat_42	159	0	100	46.8	23.8	.040	.000
Stat_43	159	0	100	54.1	21.5	.036	.000
Stat_44	160	0	100	55.6	23.2	.038	.000
Stat_45	159	0	100	66.4	24.3	.064	.000
Stat_46	160	20	100	80.8	19.5	.053	.000
Stat_47	158	0	100	63.5	20.8	.036	.000
Stat_48	159	20	100	53.5	19.9	.034	.000
Stat_49	160	20	100	70.3	19.9	.033	.000
Stat_50	160	0	100	56.0	23.2	.041	.000
Factors							
Learning*	150	26.7	91.7	60.7	12.4		
Teachers*	150	36.4	98.2	64.3	10.3		
Academic*	153	20.0	82.5	59.1	11.8		
Atmosphere*	152	31.7	88.3	62.4	10.8		
Social*	148	22.9	88.6	59.8	12.4		
Total DREEM	129	36.5	83.5	61.6	9.8		
Factor 1	142	11.1	82.2	53.1	14.0		
Factor 2	154	22.0	94.0	67.5	12.4		
Factor 3	149	27.5	100.0	74.6	11.4		
Factor 4	156	16.0	92.0	62.4	13.9		
Factor 5	155	28.0	100.0	61.2	13.5		

SD: Standard Deviation; *for original DREEM factors; Factor 1: Teaching, learning and teachers; Factor 2: Teachers and teaching; Factor 3: Atmosphere and social relationships; Factor 4: Student's self-awareness; Factor 5: Negative environment;

Cronbach's a, for the total questionnaire (50 items) was 0.925, based on standardised items and increased to 0.934 after the omission of 3 items (17, 25, 26). This value indicates that the total

scale has excellent internal consistency. Three items that had a low item total correlation, q17 (r = 0.081), q25 (r = 0.020) and q26 (r = -0.120), were removed from the final EFA. The average inter-item correlations (coefficient α-values) for the total scale was 0.205, ranging from -0.238 to 0.770 for each item.

After exploring four possible EFA models from 4 to 7 factors, the final analysis identified five new factors accounting for 44.1% of the variance (Tables 2, 3).

The first factor consisted of items 41, 43, 44, 29, 21, 42, 27, 12, 13, 22, 32, 36, 3, 5, 14, 30, 20 and 16, which referred to *teaching, learning and teachers.* Items 22 and 36 loaded into two factors. The second factor consisted of items 2, 1, 40, 37, 45, 23, 24, 7, 38, 11 and 35, which referred to *teachers and teaching*. The third consisted of items 18, 34, 19, 6, 15, 46, 47, and 49 and referred to *atmosphere and social relationships*. The fourth factor consisted of items 31, 28, 10, 4 and 33, explaining *student's self-awareness*. Finally the fifth factor consisted of items 9, 39, 48, 8 and 50 referring to *negative environment* (Table 3).

TABLE 3

Model explaining Explanatory Factor Analysis after Varimax rotation and Corrected Item-Total Correlation

| | Factors | | | | | Corrected Item-Total Correlation |
	1	2	3	4	5	
Stat_41	.684					.553
Stat_43	.661	.316		.347		.754
Stat_44	.658			.303		.663
Stat_29	.639					.476
Stat_21	.634	.362				.635
Stat_42	.584	.308				.676
Stat_27	.560					.454
Stat_12	.559					.398
Stat_13	.546					.592
Stat_22	.545		.438			.720
Stat_32	.528					.505
Stat_36	.508			.419		.473
Stat_03	.463	.347				.480
Stat_05	.462					.381
Stat_14	.458			.330		.587
Stat_30	.409					.381
Stat_16	.444		.371			.581
Stat_20	.452	.312				.580
Stat_02		.681				.561
Stat_01		.584		.316		.523
Stat_40		.556	.335			.435
Stat_37		.490				.501
Stat_45	.350	.487				.576
Stat_23		.469		.316		.406

Stat_24		.453				.514
Stat_07	.341	.388		.306		.581
Stat_38	.362	.386				.533
Stat_11		.345				.326
Stat_35		.328		.317		.464
Stat_18			.734			.550
Stat_34			.562		.350	.402
Stat_19			.554	.331		.446
Stat_06			.544			.348
Stat_15			.518			.352
Stat_46			.513	.342		.247
Stat_47		.328	.451			.506
Stat_49		.301	.359			.444
Stat_31				.458		.386
Stat_28				.677		.327
Stat_10				.504		.328
Stat_04				.471	.300	.283
Stat_33	.330		.319	.424		.430
Stat_09					.617	.329
Stat_39					.612	.266
Stat_48					.582	.344
Stat_08		.342			.580	.296
Stat_50					.538	.230

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 11 iterations. Factor 1: Teaching, learning and teachers; Factor 2: Teachers and teaching; Factor 3: Atmosphere and social relationships; Factor 4: Student's self-awareness; Factor 5: Negative environment; significant loadings in bold.

The above analysis revealed that many items with similar concept were allocated to different factors. Further, in this five factor model not all items were able to load higher than 0.400. As can be seen in Table 3, items 7, 38, 11 and 35 (in the second factor) and item 49 (in the third factor) had loadings lower than 0.400 (Schönrock-Adema et al., 2009) but higher than 0.300 that is often used in factor analysis loadings. It was decided to keep those questions.

Regression analysis showed that all items were significant (P<0.0001) determinants of the overall questionnaire, with loadings (beta) for each question from 0.028 to 0.076, meaning that every question contributed to the overall score about 2.8% to 7.6% (Table 2).

The findings were interpreted as previously published (Dimoliatis, 2010; Kossioni et al., 2011): score <25, very poor educational environment; 25-39.9, poor; 40-49.9, rather poor; 50-59.9, reasonably good; 60-74.9, good; 75-100, very good. The overall mean score of the students' perceptions of the educational environment was good (61.58%) (Table 2). Descriptive statistics for each of the 50 statements, the five new factors and the five original subscales are presented in Table 2.

The variation between the 2nd- and the 3rd-year of studies are presented in Table 4. The original subscales did not present any significant differences between the two years. When the new subscales were analysed only factor 1 (teaching, learning and teachers) had a significantly

lower score in the 2nd-year students. In the individual item analysis significant differences were recorded between 2nd- and 3rd-year students in items 6, 11, 25, 39, 32 and 41 (Table 4).

TABLE 4
Variation between the 2nd- and the 3rd-year students' perceptions

	2nd year		3rd year			
	Mean	SD	Mean	SD	t-test	p
Learning*	59.4	13.5	61.6	11.4	-1.072	.286
Teachers*	62.8	10.1	65.3	10.3	-1.460	.147
Academic*	57.9	14.3	59.8	9.6	-.916	.361
Atmosphere*	60.6	11.3	63.8	10.3	-1.779	.077
Social*	59.1	12.3	60.3	12.6	-.558	.578
Total DREEM	60.7	10.5	62.1	9.3	-.815	.416
Factor 1	50.2	14.9	55.2	12.9	-2.124	.035
Factor 2	67.7	12.5	67.3	12.4	.161	.872
Factor 3	73.4	10.4	75.4	12	-1.035	.302
Factor 4	61.5	13	63.1	14.5	-.690	.491
Factor 5	60.4	12.2	61.8	14.5	-.651	.516
Single items with significant t test difference						
Stat_6	69.1	21.1	79.3	16.8	-3.278	.001
Stat_11	64.9	19.5	73.8	20.9	-2.722	.007
Stat_25	42.0	26.6	49.9	23.5	-1.977	.050
Stat_39	53.9	27.1	65.3	17.7	-3.041	.003
Stat_32	44.5	24.1	54.9	20.8	-2.924	.004
Stat_41	48.5	23.3	58.0	19.3	-2.733	.007

SD: Standard Deviation; *for original DREEM factors; Factor 1: Teaching, learning and teachers; Factor 2: Teachers and teaching; Factor 3: Atmosphere and social relationships; Factor 4: Student's self-awareness; Factor 5: Negative environment

DISCUSSION

This validation study has shown that DREEM had an excellent internal consistency as Cronbach's alpha was 0.925 (Kline, 1986). However, the explorative factor analysis revealed a different model from the one proposed in the original DREEM study (Roff et al., 1997). Other DREEM studies in health sciences' environments also identified different factor solutions than the original questionnaire (de Oliveira Filho, Edson Vieira & Schonhorst, 2005; Wang, Zang & Shan, 2009; Dimoliatis et al., 2010; Jacobsson, Danielsen & Edgren, 2011; Kossioni et al., 2011). This has been attributed to the consensus generation of the original factors (Dimoliatis et al., 2010), to different perceptions of the learning environment in different levels of training (residents compared to undergraduate students) (de Oliveira Filho, Edson Vieira & Schonhorst, 2005), or to cultural differences between countries (Wang, Zang & Shan, 2009).

The original factors were not maintained in all three studies in Greece in Schools of Medicine, Dentistry and Education (Dimoliatis et al., 2010; Kossioni et al., 2011). This may indicate that both methodological and discipline related factors could be implicated.

According to the statistical analysis, statements 17, 25, and 26 had a low item total correlation and were removed from the scale. A misunderstanding of items 17 and 25 was also observed in the study in Greek Medical Schools (Dimoliatis et al., 2010). Further, the same low item total correlation for item 17 "Cheating is a problem in this department" has been found in the studies of Wang and colleagues (2009) and Jacobsson and colleagues (2011). Perhaps the Greek students have also misunderstood the statement as it wasn't clear to them if it implied cheating only at exams or in general. The content of the negative statement 25 "The teaching overemphasises factual learning" was probably not understood by the students. Finally, the statement 26 "Last year's work has been a good preparation for this year's work" might have been misunderstood as the inventory was distributed to students in January and it wasn't clear to which year it referred to.

The results of this study agree with those of the Greek Medical and Dental Schools (Dimoliatis, 2010; Kossioni et al., 2011), concerning three items (15, 19 and 46) scored in the very good area (>75%), which are related to social aspects. The social factors were considered by Greek students as very good irrespective of the discipline studied. Furthermore, in the present study the item 2 "The teachers are knowledgeable" was also scored in the very good area with 78%. Lack of an efficient stress-support system, lack of appropriate feedback from teachers, and the fact that students are bored during the courses have also been recorded in all three Greek studies (Dimoliatis, 2010; Kossioni et al., 2011).

The factor analysis identified some problems of low loadings according to Schönrock-Adema and colleagues (2009) criteria. Seven items had loadings lower than 0.400 but higher than 0.300 which is acceptable and often used.

The overall 62% score shows a very good educational environment in DESECE compared to 54% and 56% (reasonable good) in the Greek Medical and Dental Schools respectively (Dimoliatis, 2010; Kossioni et al., 2011). It can be suggested that the content of the studies in a health sciences' institution (illness and management of patients) can be very stressful, and demanding particularly when a traditional teaching approach is followed. The lowest scores were recorded for subscale 1: teaching, learning and teachers. However as items with different meanings are included in this factor no clear conclusions can be drawn.

DREEM was not able to identify significant differences between the 2nd- and the 3rd-year students. Statistically significant differences were recorded between the 2nd- and the 3rd-year of studies only in the new subscale 1. However items were not clearly allocated in the new factorial model and no accurate conclusions can be drawn. In general, all factors showed better scores in the 3rd-year students.

One might have expected to find some significant differences between two years as the curriculum of DESECE gives more emphasis to practical training in the last two years of studies. A tendency for lower scores in the clinical years was recorded in dental DREEM (Kossioni et al., 2011). This may be explained by the variation in the content of the practical training in the two Schools. Dental students have to independently treat patients which can be very stressful if they have limited experience, while the DESECE students come into contact with children and have to plan and implement activities for them under supervision.

There are some limitations in the present study. The questionnaire was administered to a small number of students, all attending the same Department and the results cannot be generalised in the field of sciences of education. The instrument needs to be tested in other

educational schools to cross-validate the findings. We were also not able to investigate gender differences due to the small amount of male students that attend the Department.

Comparison with other relevant scales was not performed as there is no other similar instrument in Greek measuring the environment in Schools of Education.

Under the limitations of the present study the use of the DREEM instrument in an educational school environment needs further investigation. The original factors were not maintained, while some statements seemed irrelevant to the other items in the new factors. Further, some of the items did not follow the Schönrock-Adema and colleagues (2009) criteria and their removal has been discussed. Even though the instrument is a highly recommended tool for use in a medical school environment it seems that different aspects should be considered for different educational settings.

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