RESEARCH

The Health Education Learning Environment Survey: Factor Structure Analysis with Pharmacy Students

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Objective. While high-quality learning environments are increasingly recognized as vital for health professions education programs and student success, there are no tools that have been validated for use within the pharmacy education context. This study seeks to assess whether the six-factor structure of the Health Education Learning Environment Survey (HELES) will replicate in a sample of pharmacy students.

Methods. The study was conducted in a Doctor of Pharmacy program offered at a Western Canadian university. A sample of 288 pharmacy students, across two years of data collection, completed the 35-item HELES as an anonymous and online survey.

Results. While the six-factor model of the HELES, as a whole, did not replicate through confirmatory factor analysis, a follow-up examination of unidimensionality for the individual subscales of the HELES showed that five of the six subscales met this requirement. One subscale, the work-life balance subscale, was better represented by the dimensions of time management and emotional well-being.

Conclusion. These results provide preliminary support for the use of the HELES among pharmacy students, with additional research being needed to explore the work-life balance subscale and its appropriateness for this student group. In Canada, the HELES has the potential to fill an existing local and national gap in available program evaluation tools needed for gathering evidence on pharmacy program quality, strengths, and weaknesses, and to inform continuous quality improvement efforts and accreditation standards.

Keywords: learning environment, HELES, pharmacy, program evaluation

INTRODUCTION

High-quality learning environments (LEs) are increasingly recognized as vital for health professions education and student success,¹ yet have received very little attention in the pharmacy education literature. Considered an essential contributor to effective learning in today's rigorous and high stakes health professions programs, LE quality has been linked to many positive outcomes such as greater student satisfaction, academic performance, professional development, and less student stress, exhaustion, and burnout.²⁻⁴ While specific definitions remain contested, the LE has been described broadly as everything that surrounds learning including the psychological, social, cultural, and physical dimensions of the learning context. Rusticus et al.⁵ and Gruppen et al.,⁶ for example, define the LE as a complex psycho-social-physical construct co-created by students, faculty, social groups, and organizational structures in a particular physical setting and influenced by contextual climate and cultural norms. Measures of LE quality are also variable, confounded by limited agreement on the set of features that make up the LE and support measures of quality, and the absence of theoretical frameworks for examining LE quality.⁷ To date, LE research spanning five decades has focused predominantly on medical education resulting in the development of at least 11 LE measures. Most of these measures have been characterized as context-specific tools with limited uniformity and generalizability.⁷ Of these, the Dundee Ready Education Environment Measure (DREEM) is among the most familiar and widely used.⁸ Designed in the late 1990s to measure LE quality in medical schools, the DREEM has been translated into eight languages and used in at least 20 different countries across medical, nursing, dental, physiotherapy and public health programs.⁹ Used for a variety of evaluation-related purposes that include generating institutional profiles of strengths and weaknesses, comparison of different groups, and examining the relationship between the LE and program outcomes such as student achievement and continuous quality improvement,⁹ the DREEM has been criticized for cultural bias and a lack of sufficient validity evidence¹⁰ and theoretical foundation.⁷

In response to these claims, the Health Education Learning Environment Survey (HELES) was developed and preliminarily validated as a global measure of the LE for medical students.⁵ The six-subscale, 35-item, HELES reflects Moos's learning environment framework dimensions of personal development, relationships, and system maintenance change¹¹ that address student's personal motivations within the environment, the nature and quality of relationships with peers and faculty/staff, and the broader institutional setting, respectively. Rusticus and colleagues⁵ renamed the system maintenance and change dimension to school culture. Figure 1 provides an overview of these dimensions and their associated subscales. While the HELES was initially intended for use with undergraduate medical students, recently it was broadened in collaboration with other health professions schools and Faculties (nursing, occupational therapy, pharmaceutical sciences).^{5,12} Having a tool that is relevant to multiple health professions programs acknowledges the similarities and shared concerns regarding the LE across programs and can foster increased collaborations among programs to share their experiences, insights, and challenges regarding program improvements. In the Canadian pharmacy education context, this research represents the first attempt at developing a global measure of LE quality required for program accountability and accreditation purposes.¹³

Currently, the factor structure of the HELES has only been validated among undergraduate medical students. The purpose of this study was to examine the factor structure of the HELES in a sample of pharmacy students attending a Doctor of Pharmacy (PharmD) program at a Western Canadian Faculty of Pharmaceutical Sciences (PS). Using HELES data collected over two consecutive years, confirmatory factor analysis was applied to assess whether the six-factor structure of the HELES would replicate in this sample.

METHODS

The PS program was a new 'two plus four' entry-to-practice PharmD program (ie, two years of prerequisite sciences courses followed by a four-year pharmacy curriculum). At the time of the study, the first three years of the program comprised term-long, 15 to 18 credit, module-based lecture and skill development foundations and medication management courses, electives, and summer practicums in various pharmacy practice settings.¹⁴ The fourth-year combined discipline-specific courses with extended experiential learning opportunities to help students achieve practice readiness upon graduation. A total of 224 students are admitted per year with maximum enrollments of 896.

For the first pilot-year of the study, only first and second-year students were invited to participate, with a total of 94 (21%) completing the survey. For this sample, the average age was 24.3 years ($SD=3.55$) and 66 students identified as female (70%), 23 as male (24%), and two as other (2%); three students did not identify their gender (3%). The students were roughly evenly split between years with 43 (46%) first year students and 51 (54%) second year students. For the second year of the study, all four years of students were invited to participate, with a total of 194 (22%) completing the survey. The average age of this sample was also 24.3 years ($SD=6.22$) and 125 students identified as female (64%), 65 as male (34%), two as other (1%), and three did not provide gender information (2%). Across years, respondents included 41 first year (21%), 44 second year (23%), 53 third year (27%), and 56 fourth year (29%) students. Aligned with the Faculty's benchmark response rates for student evaluations of teaching and courses (18% with variations between years commonplace)¹⁵ and student data collected annually by the Faculty, the total number and demographic breakdown of respondents was representative of the student body.

All participants completed the six-factor, 35-item, HELES.⁵ As shown in Figure 1, the HELES personal development dimension comprises the work-life balance subscale (seven items) assessing perceptions of workload and stress, and the clinical skill development subscale (four items) assessing perceived opportunities to work with patients and to learn and practice clinical skills. Within the HELES relationships dimension, the faculty relationships subscale (eight items) assesses the nature and support from faculty and clinical staff while the peer relationships subscale (four items) assesses the nature and degree of support from peers. Finally, the HELES school culture dimension includes the expectations subscale (four items) assessing self and perceived faculty awareness of student abilities and expectations, and the educational setting and resources subscale (eight items) assessing perceptions of the overall school climate, including aspects of the physical environment, perceptions of diversity, and available resources. The specific wording of each subscale item, the item sequence number in the HELES, and those items that are reverse-scored can be found in Table 2. Each item is rated on a five-point scale ranging from one (Strongly disagree) to five (Strongly agree). Item ratings can be averaged to give total scores for each subscale and an overall LE score. For each subscale and the overall LE score, a higher score indicates a more positive perception of the LE.

After receiving ethical approval from the university's Behavioral Research Ethics Board (H17-00893), the HELES was administered to students using a secured online survey platform. Study data was collected in the spring of 2017 and 2018, towards the end of their current year of training. The survey remained open for three weeks with at least two reminders sent during this period. Participation in the study was anonymous and voluntary.

Data Analysis

Confirmatory factor analysis (CFA), which is used when one is trying to verify a known factor structure with a new sample, was used initially to confirm if the six-factor structure of the HELES found with medical students would replicate in a sample of PS students. Mplus version eight and a weighted least squares estimator (WLSMV estimator) was used to account for the ordered categorical nature of the data. Parameter estimates were based on the polychoric correlations for all pairwise data. Model fit, which examines how well the observed data fits the proposed model, was assessed using chi-square (χ^2), the root mean square error of approximation (RMSEA), the standardized root mean square residual (SRMR), the comparative fit index (CFI), and the Tucker-Lewis index (TLI). Based on Anunciacao's recommendations,¹⁶ acceptable model fit was deemed to be achieved if chi-square was nonsignificant, RMSEA was $\leq .08$ ($\leq .05$ is ideal), SRMR was $\leq .08$ ($\leq .05$ is ideal), and CFI and TLI were $\geq .90$ ($\geq .95$ is ideal); at least three of the five fit statistics needed to indicate acceptable model fit.

If model fit was poor, an individual analysis on each subscale would be conducted to test for strict unidimensionality and then essential unidimensionality, if needed. According to Slocum-Gori and Zumbo,¹⁷ strict unidimensionality is met when items load on only one latent variable (the items measure a single concept only), whereas essential unidimensionality is met when items represent one dominant latent variable, with secondary minor dimensions. Said another way, essential unidimensionality indicates that the items measure a main concept as well as some smaller concepts; but these smaller concepts have a relatively small influence on the item scores and can be ignored. While strict unidimensionality is preferred, essential unidimensionality is a sufficient condition to combine a set of items into a subscale.¹⁷ Strict unidimensionality was tested by conducting a CFA on the items of each subscale separately using Anunciacao's¹⁶ criteria, as indicated above. Essential unidimensionality was tested through exploratory factor analysis (EFA). EFA seeks to identify how many factors (or concepts) are present in the data; our intention was to identify if there was one or more factors present. The number of factors to retain was determined using multiple criteria: statistical fit, scree plot, parallel analysis, and ratio of the first to second eigenvalue being greater than three.¹⁷ Statistical fit was assessed via chi-square, RMSEA, SRMR, CFI, and TLI, as described above. A scree plot is a visual plot of the eigenvalues, where an eigenvalue is a measure of how much item variance a factor explains. With 35 items in the HELES, there are 35 eigenvalues produced. Eigenvalues above one indicate that a factor can explain more than an item on its own and thus eigenvalues less than one are generally discarded. When looking at the scree plot, one is looking for a sharp decline, or bend, in the plot, as this is used as a cut-off to separate out the meaningful factors. In a parallel analysis, a random dataset with the same number of items and participants is simulated using a software program and a factor analysis is run on this simulated dataset. The largest eigenvalue from the factor analysis on this simulated dataset is then used as a cut-off for determining the number of factors to extract from the real data, as the number of eigenvalues greater than this cut-off represent meaningful factors to extract. Examining the ratio of first to second eigenvalue seeks to differentiate between multi-dimensionality (there is more than one meaningful factor in the data) and essential unidimensionality (there is one dominant factor, and any other factors are not meaningful). When there is a large gap between the first two eigenvalues (greater than a three to one ratio), it supports the argument that there is one dominant factor, and any other factors are minor. Additionally, we examined how well each of the items was correlated with a factor by examining the factor loadings. Factor loadings of .40 or greater were considered meaningful.¹⁸ As a final step, reliability for each subscale was assessed through Cronbach's coefficient alpha with values of .70 or higher deemed acceptable ($> .80$ is ideal).¹⁸

RESULTS

As seen in Table 1 (Row 1), only one of the fit statistics (SRMR) met the requirements for model fit for the six-factor model, indicating that the six-factor model did not replicate with the sample of PS students. Since the results of the CFA indicated poor model fit, we next examined each subscale individually for strict unidimensionality. As seen in Table 1 (Rows 2-7), all subscales, except for the work-life balance subscale, met the requirements for strict unidimensionality, indicating that it is acceptable to average the items within each subscale into an overall mean score for that subscale. Cronbach's coefficient alpha for these subscales also indicated acceptable reliability: clinical skills development=.85, faculty relationships=.90, peer relationship=.75, expectations=.84, educational setting and resources=.89. Table 2 presents the items and the associated CFA factor loadings for each of the HELES subscales; all exceeded the .40 factor loading minimum.

Essential unidimensionality was then assessed for the remaining Work-Life Balance subscale. The results of the EFA analysis (i.e., examination of statistical fit, scree plot, parallel analysis, and ratio of the first to second eigenvalue) suggested the presence of two factors, including three of the five fit indices indicating acceptable model fit for the two-factor solution: $\chi^2=40.67$ ($p<.001$), RMSEA=.12, SRMR=.04; CFI=.98; TLI=.95. These two factors were identified by the

authors as consisting of items related to time management (items 1, 4, 10, 26) and emotional well-being (items 23, 24, 29); both met the conditions for a new subscale. For the time management subscale, the factor loadings ranged from .65 to .78 while the factor loadings for the emotional well-being subscale ranged from .54 to .85. Coefficient alpha for these two subscales were .79 and .69, respectively indicating acceptable reliability for the time management factor.

DISCUSSION

While the HELES was developed to assess the LE among health professions programs, the factor structure of the scale had only been established among undergraduate medical students. This study has extended this validity evidence by examining its factor structure among PS students. Instead of the original six subscales, the results of this study suggest that one of the original subscales (Work-Life Balance) is better represented by two subscales: time management and emotional well-being. The former relates to managing one's workload and extracurricular activities, the latter relates to perceptions of stress and well-being. While the coefficient alpha for the time management subscale (four items) was acceptable, the somewhat low value for the emotional well-being subscale was likely due to the limited number of items in this subscale (three). Given that these results diverge from the intended six factor structure of the HELES, additional research is needed to confirm this seven-factor structure for PS students, and if confirmed, consideration should be given to potentially expanding the emotional well-being subscale to improve its reliability.

Regardless of the psychometric findings, the development of a PS-specific HELES has significant and timely implications for the on-going development of the new PharmD program, student learning and the student learning experience. As mentioned previously, there is currently no global measure of LE quality within the PS Faculty or nationally in Canadian academic pharmacy despite accreditation standards (Standard 2) aimed specifically at this program dimension.¹³ Importantly, the HELES fills a critical gap in available program evaluation tools for gathering evidence on program strengths and weaknesses needed to inform continuous quality improvement efforts. Administration of this measure also provides an important mechanism for listening to students about their learning experiences, responding to their learning needs on a continuous basis, and forming greater context-specific understanding of the impact of our curriculum and pedagogical practices.¹⁹ For example, in addition to providing previously unavailable insights into five of the six subscales, findings from the HELES has, for the first time, provided confirmatory evidence of student stress and workload challenges associated with our curriculum and teaching practices. Though preliminary, these findings have, in turn, opened up proactive strategies for addressing the issue, including strengthening policies and practices of our Office of Student Services. In this regard, expanding the HELES Work-Life Balance subscale to include time management and emotional well-being in the PS HELES would be welcome and particularly timely for addressing the growing prevalence of student burn-out in PharmD programs.²⁰

Some study limitations need to be noted. First, the HELES survey was sent to all PS students in the program, but only about 21% of students completed the survey in study years one and two, respectively. Students at UBC are required to complete multiple surveys and, because this survey was voluntary, it is likely that only students who had an interest in this study chose to participate (which is a comparable scenario to most research studies involving student surveys). While the sample size was sufficient to conduct the factor analyses, there is the possibility of sampling bias that could have influenced the study results. Second, these results are based on a single institution and additional evidence is needed to examine the generalizability of these results. Third, as the HELES is a self-report measure, the data only reflect student perceptions of the learning environment which is recognized as a major limitation of most learning environment research.⁶ Thus, these perceptions may not reflect the true quality of the learning environment and may be limited to only those aspects of the environment that students have been exposed to.

CONCLUSION

The LE is an important concept for pharmacy educators yet is rarely defined or specifically studied. Known more for what it supports rather than what it is, the LE is perceived to have both direct and indirect influences on student learning including their engagement in what is taught, their motivation to learn, and their sense of well-being, belonging, and personal safety. Drawing on a significant body of research in medical education and other health professions, pharmacy educators stand to benefit from greater research attention on the complex LE construct to advance the quality of pharmacy education and student achievement. The results of this study provide preliminary support for the use of the HELES among pharmacy students, with additional research being needed to explore the work-life balance subscale and its appropriateness for this student group. In Canada, the HELES has the potential to fill an existing local and national gap in available program evaluation tools needed for gathering evidence on pharmacy program quality, strengths, and weaknesses, and to inform continuous quality improvement efforts and accreditation standards.

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Table 1. Goodness-of-Fit Indicators for the Confirmatory Factor Analysis of the Health Education Learning Environment Survey

Model	<i>df</i>	χ^2	RMSEA	SRMR	CFI	TLI	Strict Unidimensionality?
Six factor HELES model	545	985.39 ^b	.10	.07	.89	.88	No
Work-life balance (7 items)	14	335.39 ^b	.28	.09	.79	.69	No
Clinical skill development (4 items)	2	11.92 ^a	.13	.02	.99	.98	Yes
Peer relationships (4 items)	2	16.07 ^b	.16	.03	.98	.93	Yes
Faculty relationships (8items)	20	130.68 ^b	.14	.04	.97	.95	Yes
Expectations (4 items)	2	27.32 ^b	.21	.03	.98	.94	Yes
Educational setting and resources (8 items)	20	131.79 ^b	.14	.05	.98	.97	Yes

^a $p < .05$.
^b $p < .001$.
df=degrees of freedom; χ^2 =chi-square; RMSEA=root mean square error of approximation; SRMR=standardized root mean square residual; CFI=comparative fit index; TLI=Tucker-Lewis index

Table 2. Items and Factor Loadings for the Six Subscales of the Health Education Learning Environment Survey

Item #	Item	Factor loading
Factor 1: Work-Life Balance		
1	I have sufficient time to engage in extracurricular activities	.82
4	I have sufficient opportunities to pursue scholarly interests in my health profession	.85
10	I am able to maintain a healthy work-life balance	.83
23	I feel over-stressed in the non-clinical environment*	.40
24	I feel over-stressed in the clinical environment*	.15
26	I have sufficient time to engage in self-directed activities that support my learning	.75
29	My workload is often overwhelming*	.31
Factor 2: Clinical Skill Development		
3	I have sufficient opportunities to practice clinical/procedural skills	.80
16	I have sufficient opportunities to engage in meaningful patient care tasks	.88
20	I have sufficient opportunities to work with patients	.77
25	I have sufficient opportunities for hands-on learning	.80
Factor 3: Faculty Relationships		
5	Faculty provide me with meaningful feedback about my performance	.73
14	Faculty are supportive when I make mistakes	.83
15	Faculty listen to my feedback	.73
18	Faculty are willing to take the time to support my learning	.86
19	I receive sufficient supervision to support my learning	.81
22	I am treated with respect by faculty/staff	.80
34	have sufficient opportunities to meet informally with faculty to support my learning	.74
35	I have developed connections with faculty	.55
Factor 4: Peer Relationships		
9	I provide support to my peers	.60
11	I have peers who I can turn to when I need help	.80
13	I have developed a strong sense of community with my peers	.85
17	I make an effort to get to know my peers	.58
Factor 5: Expectations		
7	Faculty/clinical staff know what is expected for my current level of professional training	.82
8	I know what is expected of me in each course/rotation	.77
27	The expectations for my performance are clearly communicated to me	.83
28	Faculty adhere to the learning objectives	.75
Factor 6: Educational Setting and Resources		
2	The technology used at my program site supports my learning	.76
6	Policies are consistently applied across students	.74
12	I am in a safe environment for learning	.81
21	A variety of teaching and learning modalities are used to support my learning	.73
30	The quality of the physical environment (e.g., classrooms, hospitals, study space) is sufficient for my learning	.55
31	I am in a program that supports diversity	.90
32	The curriculum content respects diversity	.90
33	Faculty are welcoming of diversity	.90

* = reverse-scored item.

Figure 1. The Three Dimensions and Six Subscales of the Health Education Learning Environment Survey (HELES)