

Evaluation of an Interprofessional Problem-based Learning Module on Care of Persons Living with HIV/AIDS

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Abstract

Background: Interprofessional education (IPE) holds great promise in continuing to reform the management of complex chronic conditions such as HIV/AIDS, and Problem-based Learning (PBL) is a suitable format for IPE. This study aimed to evaluate the effectiveness of a large scale, compulsory interprofessional PBL module on HIV/AIDS education. In 2004, 30 physical therapy and 30 medical students at the University of Saskatchewan engaged in the HIV/AIDS PBL module. By 2007 over 300 students from seven healthcare programs were involved.

Methods and Findings: The module was evaluated over the years using student satisfaction surveys, focus groups, self-assessments, and in 2007 with written pre-test/post-tests. Students rated the learning experience about both HIV/AIDS and about interprofessional collaboration, at 4 or 5 out of 6 and effect sizes fell between $d = .70$ and 3.19 . That only one pre-test/post-test study was conducted at a single institution is one of the limitations of this study.

Conclusions: Students generally thought highly of the interprofessional PBL module on HIV/AIDS and learned a considerable amount. Although more research is needed to substantiate the self-assessment data, establish what and how much is being learned, and compare PBL to alternative methodologies, PBL is a promising approach to IPE.

Keywords: Interprofessional education, Problem-based learning, HIV/AIDS

Introduction

A compulsory, large scale, interprofessional problem-based learning (iPBL: interprofessional PBL) module for the care of persons living with HIV disease has been successfully implemented at the University of Saskatchewan within otherwise conventional (largely traditional lecture and laboratory-based) health sciences education programs. Solomon, Salvatori, and Guenter [1] previously described an interprofessional problem-based learning course on rehabilitation issues in HIV that was voluntary and involved only 10 selectively recruited senior-level students from four programs. Solomon, Binkley, and Stratford [2] reported an evaluation of two largely problem-based curricula at two different universities but with students from only one entry-level professional program (physical therapy). This HIV/AIDS module evaluated in the current study is unique because it

- was conducted on a large scale,
- involved many disciplines, and
- was a mandatory part of regular entry level health professions programs.

The Comprehensive Care Guidelines for Persons Living with HIV/AIDS [3] recommend a wide range of activities and services to meet the medical, emotional, and economic needs of persons living with HIV/AIDS, as well as their family members,

and caregivers. Around the world, the profile of HIV infection is constantly changing. Although once viewed as an illness progressing quickly to death, HIV infection can now present as a disease with an uncertain natural history and as, perhaps, a chronic manageable disease for those with access to antiretroviral therapy. Thus, the needs of persons infected with HIV are multi-faceted, variable, and complex [4,5]. Developments in the medical management of HIV also present new challenges in responding (for example, to long-term side effects of the medications), which also impact the role and scope of practice of various healthcare providers. According to the Canadian Working Group on HIV and Rehabilitation [6] care for persons living with HIV involves a wide range of health professionals and, therefore, must be inter-professional in nature.

Interprofessional education (IPE) holds great promise in helping to reform the management of many complex conditions such as HIV/AIDS [7]. Many experts believe that for health professionals to work together effectively they should be trained to do so in their undergraduate or pre-licensure professional training programs [8-10]. The goal of IPE is to promote interprofessional competencies such as understanding of professional roles, communication and negotiation skills, and enhanced patient/client-centred care [1,11] that will carry over into practice.

To be effective, theorists have suggested that undergraduate IPE should make extensive use of relevant, well-structured, and progressively more complex cases through the expert application of cooperative and experiential learning principles [9,11-13]. Furthermore, interprofessional case discussions and studies must be organized to include the five essential features of cooperative learning [14]:

- positive interdependence,
- face-to-face interaction,
- social skills,
- group processing, and
- individual accountability.

Similarly, students working in cooperative groups on relevant cases should cycle through the four stages of experiential learning: planning, acting, observing, and, especially, reflecting [15]. Problem-based learning (PBL) incorporates many of the important principles of both cooperative and experiential learning and therefore brings several natural strengths to IPE [13].

PBL and its unique advantages for IPE

PBL is a small group case study approach that presents a situation (problem) to learners for which, by design, they are generally unprepared [16]. Collectively, the participants are therefore required to identify and then seek out the knowledge they can subsequently use to address the case before them. They also learn from each other and are both teachers and learners in this mutually supportive and cooperative process.

Some researchers have indicated that PBL fosters a motivational environment that enhances the attainment of disciplinary knowledge and facilitates collegial group work [17,18]. Others argue, however, that the effectiveness and sustainability

of students' retained knowledge using a PBL approach compared to a conventional curricula have not been sufficiently tested and no firm conclusions can yet be drawn [19,20]. Some systematic reviews on the effectiveness of PBL [21,22] conclude that the existing literature provides inadequate or equivocal evidence about the effectiveness of PBL. Others note, however, that PBL emphasizes constructive, self-directed, collaborative, and contextual learning processes [18], characteristics that make PBL well suited to IPE. A recent review [23] found evidence to suggest that PBL enhanced student ability to deal with uncertainty, understand ethical and legal issues, communicate effectively, and to sustain life-long learning, although caution should be exercised in accepting these results [24]. The debate over the effectiveness of PBL remains ongoing.

Generally students (and tutors) enjoy the PBL learning experience [25] more than conventional methods and students feel that they learn more [25-28]. Some have found that students believe that they are learning to think [29] and, as a result of the PBL process, to communicate better and to work in groups [26,29]. This evidence suggests that students consistently report PBL to be a better and more enjoyable way to learn than more traditional forms of knowledge acquisition.

A particular strength of iPBL compared to case-based learning is its relative ease of incorporating multiple curricula. As mentioned above, all students enter the process generally unprepared, but they learn from their own explorations and investigations between sessions and from each other [16]. It is not necessary, as it is for case-based discussions, that all students have been taught the concepts and principles needed to successfully contend with the problematic aspects of the iPBL case. iPBL eliminates the need for complex curricular coordination of content knowledge because the students respectfully teach each other and themselves much of what they need to know for the case at hand.

Extensive evaluation of iPBL is absent in the literature. Expense, scheduling for multiple programs, and the requirement for numerous tutors, make implementation difficult and have not been addressed. In addition, students raised concerns about PBL: frustration with discussions either beyond or below their expertise, tutor variability, and dysfunctional tutor groups [19,26,30].

The HIV/AIDS PBL module development and implementation

In 2000, the School of Physical Therapy made a commitment to enhance curricular content in the area of HIV/AIDS in order to challenge physical therapy students to reconceptualize HIV using a rehabilitation framework [5]. Working in partnership with AIDS Saskatoon (a local community-based service organization for people living with HIV/AIDS) and in collaboration with a nationally recognized physical therapy expert in this area, faculty members developed a PBL case for physical therapy students centered on HIV/AIDS care. They created this PBL module because they wanted to introduce the unique strengths of PBL as another (and new) method of learning into their generally conventional program. Although the case was initially used with physical therapy students only, it was the intention from the beginning to find other health profession program partners.

Table 1:
Module participants (2001-2008)

Year (Fall)	Program	Number of students	Level of students
2001	Phys Therapy	30	Year 3
2002	Phys Therapy	30	Year 3
2003	Phys Therapy	30	Year 3
2004	Phys Therapy	30	Year 3
	Medicine	30†	Year 1
2005	Phys Therapy	27	Year 3
	Medicine	39†	Year 1
	Pharmacy	74	Year 4
2006	Phys Therapy	30	Year 3
	Medicine	10*	Year 3
	Pharmacy	84	Year 4
	Nutrition	26	Year 3
	Nursing	60	Year 4
2007	Phys Therapy	31	Year 3
	Medicine	61‡	Year 2
	Pharmacy	88	Year 4
	Nutrition	26	Year 3
	Nursing	62	Year 4
	Social Work	35	Year 4
	Clinical Psychology	5	Graduate students
2008	Medicine	70	Year 2
	Pharmacy	81	Year 4
	Nutrition	23	Year 3
	Nursing	50	Year 4
	Social Work	30	Year 4
	Clinical Psychology	5	Graduate students

†Only part of the first year medical student class of 60 participated. The others were involved in a different iPBL module focusing on Aboriginal health. *These medical students were volunteers due to a scheduling and administrative error. ‡ Beginning in 2007 second year medical students participated. At this time the class size increased, hence there were more second-year medical students participating in 2008 than in 2007.

Beginning in the fall of 2001, and for three subsequent years, the HIV/AIDS iPBL module involved about 30 third-year students from the School of Physical Therapy only. In 2004, 30 first-year medical students joined the module, followed in 2005 by the addition of 74 fourth-year pharmacy students making the module truly interprofessional. In 2006, 28 third-year nutrition and 50 final-year nursing students were added and a formal project steering committee was created. In 2007, 34 students from Social Work and five from Clinical Psychology were included bringing the total number of student participants that year to 307 from seven programs. Table 1 outlines when, at what level, and how many from each program participated in the iPBL module over the years. The partner programs were often able to tie the iPBL module to specific courses with defined objectives. In some cases, as with medicine, the connection to, and integration with, existing courses was initially tenuous.

The case and tutor probes were reviewed and modified each time students from a health sciences professional program joined the iPBL module. These revisions provided profession-specific information to the case designed to help the students from the joining program find a role within their interprofessional small group. In 2006, objectives for team work and self-directed learning were added. Appendix A includes the most recent list of objectives and the initial case information presented to the students on Day 1 of the module. Other details of the case may be obtained from the authors.

A small research and development grant through Health Canada (Interprofessional Education for Collaborative Patient Centred Practice or IECPCP) in both 2006 and 2007 made hiring part-time assistants for logistical coordination and support possible. The task of organizing this mammoth and complex project and maintaining communications with students, tutors, and program representatives became daunting in the fall of 2006, when the total number of student participants topped 200. The part-time administrative coordinator spent about 60 hours over three months organizing hundreds of students into almost 30 small groups, each group with a tutor, approximately 10 students, and separate rooms (scattered over the campus in numerous buildings) in which to meet for the three, weekly, two-hour sessions. The coordinator created iPBL groups with as many different professions represented as possible. Due to unequal numbers of students in the participating programs (Table 1), groups had as few as three to as many as six professions represented in each group. The administrative coordinator prepared packages for each group containing case materials, evaluation tools, and supplies needed to run the iPBL sessions. At a tutor orientation, prior to session one, the packages were distributed and reviewed. It would not be possible to conduct large scale iPBL modules without such administrative support.

Until recently, program representatives notified students of their iPBL group and room assignments by distributing this information to students. For recent modules, students were informed of their group and room assignments and tutor contact information by email, directing them to a website. The addition of tutor contact information allowed students to take responsibility for communicating directly with their tutors in the event of an unplanned absence. This arrangement reduced the time required of the program representatives to manage communication among students and tutors.

Tutor preparation

The two half-day PBL tutor training workshops included the following:

- pre-workshop preparation;
- small and large group discussions;
- observation of a staged but “real” PBL group facilitated by one of the workshop leaders; and
- role play practice of specific tutoring skills.

The pre-workshop preparation consisted of the guided reading of several short articles and viewing a PBL training video. The reading outlined the PBL rationale and process, key facilitation strategies and tips, and important elements of IPE gen-

erally. The video (recorded and produced at the University of Saskatchewan) provided trainee tutors with a visual demonstration in real small group settings of key tutor and group tasks to complement the print resources. In addition to the workshop, 15- to 30-minute tutor support meetings were held before and after the actual iPBL module sessions attended by at least one designated “senior” tutor. Three to five, or more, other tutors generally attended as well. Over the years students have consistently rated most tutors very highly and tutors themselves have expressed strong satisfaction with this level of training and support. Tutors’ self-assessments of skills and knowledge have been positive [31].

Methods

This module was developed to

- improve student skills in the care and management of persons living with HIV/AIDS;
- increase knowledge of the contributions of other professions; and
- give students a positive self-directed learning experience.

An evaluation of the module in these areas was conducted. Ethical approval for the study was obtained from the Research Ethics Board (Behavioural) of the University of Saskatchewan.

A student questionnaire, developed by one of the authors (MD) in 2001, was provided to the students at the conclusion of each module. The questionnaire included numerous Likert-style questions, with space for additional comments. An open-ended question asked students to comment on the facilitation of the iPBL group. The questionnaire was revised in 2005 to include items measuring module usefulness. For 2006, 2007, and 2008, the questionnaire incorporated a retrospective self-assessment of learning in the areas of knowledge of HIV/AIDS and of the roles of other healthcare professionals. Self-assessments have been shown to be reasonably accurate for determining the effectiveness of educational interventions if the data are aggregated for the group [32]. The questionnaire was further revised in 2007: some redundant items were removed and two items regarding tutor effectiveness were added. Therefore results for all questions are not available for all years. The questions used are listed in Appendix B. A principal components factor analysis was performed on the student satisfaction survey to help identify categories within the survey.

Two student focus groups were convened in 2006, consisting of medical ($N = 3$) and nutrition ($N = 2$) students. The focus group data and open-ended comments from the student questionnaire were thematically analyzed by a graduate student research assistant. The research assistant read through the written comments and identified patterns, such as similar words and expressions of similar meanings. Like comments were clustered together and labeled as themes.

In 2007, to more accurately determine what and how much students had learned [11], a pre-test/post-test design was incorporated into the evaluation plan. Before the module began, students answered open-ended questions about HIV/AIDS, caring for persons living with HIV/AIDS, and the roles of other professions related to a paper case. Following the module, students were provided with a copy of their

own original pre-test and asked to add, remove, or change (on a separate sheet of paper) their pre-module responses to the questions, based on what they had learned. Conducting the post-test in this way meant that students did not need to repeat what they had already written in the pre-test for the post-module responses.

Led by one of the authors (NM), a group of four researchers from the iPBL faculty team created the test case and the questions. They then developed the marking scheme to quantify the responses. For example, one question asked about opportunistic infections: students were given one point for each correct response. This provided some content validity for the case and questions. Two university students were trained by one of the authors (MD) to score the de-identified and coded student pre- and post-test answers. Several times the students scored the same paper and compared and discussed scoring. When strong agreement was reached they were each given different papers to score. Two authors (NM and JC) and one of the two trained university students scored 13 pre- and post-test papers. Intraclass correlation coefficients were calculated to measure the inter-rater reliability for increases in knowledge both of HIV/AIDS and other professions. Single measures reliability scores for knowledge of HIV/AIDS and other professions were .47 and .73, respectively. This indicates that there was moderate agreement between judges for knowledge of HIV/AIDS and substantial agreement for ratings of knowledge of other professions. Average measures reliability scores for knowledge of HIV/AIDS and other professions were .70 and .88, respectively. This indicates that ratings were stable when averaged across the three judges, and provided some assurance that the student raters would score similarly to the faculty.

The pre/post-test data were analyzed using paired-samples *t*-tests for increased knowledge of HIV/AIDS and interprofessional roles. Effect sizes (Cohen's *d*) were calculated for pre-test to post-test results for knowledge of HIV/AIDS and other healthcare professions. Cohen's *d* is a standardized measure of the difference between two means, where $d = .2$ indicates a small effect size, $d = .5$ indicates a medium effect size and $d = .8$ is considered a large effect size.

Results

Knowledge of HIV/AIDS

The first question of interest concerned how much students learned about caring for persons living with HIV/AIDS. Self-assessment responses were scored on a 10-point scale, with higher scores reflecting greater gains in knowledge. Mean perceived knowledge gained in 2006, 2007, and 2008 are reported in Table 2. Based on the retrospective self-assessment, there was a statistically significant gain in knowledge of HIV/AIDS overall for all three years. Thematic analysis of all student comments from the survey and the focus group held in 2006 indicated that students felt strongly that they learned real life application skills, as illustrated below:

I have learned a lot more about all of things which need to be considered for a patient with HIV/AIDS.

I learned a lot about the case (HIV) and PBL.

I think that this process of PBL is a good way to learn about a more holistic approach to a patient, recognizing all the issues surrounding this individual and what can be done to improve his/her quality of life and/or save their life.

Table 2:
Student self-assessments*

	2006 M (SD)	2007 M (SD)	2008 M (SD)
Gain in knowledge of HIV/AIDS	6.02 (1.95)	5.21 (2.08)	5.32 (1.97)
Comparison of post and retrospective self-assessments	$t(170) = 40.41$, $p < .001$; $d = 3.19$	$t(267) = 41.08$, $p < .001$; $d = 2.94$	$t(119) = 29.50$, $p < .001$; $d = 3.05$
Gain in knowledge of other professions	4.86 (2.06)	3.89 (2.04)	4.08 (1.80)
Comparison of post and retrospective self-assessments	$t(170) = 30.81$, $p < .001$; $d = 2.55$	$t(263) = 31.02$, $p < .001$; $d = 31$	$t(114) = 24.33$, $p < .001$; $d = 2.43$

*10-point scale, with higher scores reflecting greater gains

There were few meaningful differences (statistical or practical) among professions based on the self-assessments except in the case of two different cohorts of medical students. In 2006, due to program scheduling issues, the 10 third-year medical students participating in this module were volunteers. They provided low self-assessments of learning during the module. Compared with all other programs, there was a statistically significant difference. In 2007 and 2008 over 50 medical students, beginning their second year, rated their learning much higher than did their third-year colleagues (2007 ($t(60) = -2.24$, $p = .029$, $d = -.95$) and 2008 ($t(33) = -2.74$, $p = .010$, $d = -1.16$).

The results from the objective pre- and post-tests in 2007 also indicated that the students' knowledge of HIV/AIDS increased from the pre-test's ($M = 2.81$, $SD = .66$) to post-test's ($M = 3.02$, $SD = .82$), which was statistically significant ($t(259) = 19.68$, $p < .001$). The differences for both the objective pre- and post-tests and the self-assessments yielded large and very large effect sizes (Cohen's d) of 1.12 and 3.54, respectively.

However, an independent samples t -test revealed that the two raters gave significantly different ratings for the pre-test ($t(239) = -3.59$, $p = .000$), but not post-test for knowledge of HIV. As well, the difference score between pre- and post-tests for knowledge of HIV was different for the two raters ($t(239) = 2.42$, $p = .016$). Internal consistency for both the pre- and post-tests was low (Cronbach's $\alpha = .50$ and $.24$). No statistically significant differences between raters were found for pre- and post-tests for knowledge of other professions.

Knowledge of other professions

The second question of interest concerned how much the students learned about what other professions can bring to the care of persons with HIV/AIDS. The students, on a 10 point scale (with higher scores reflecting greater self-reported knowledge), assessed their knowledge about other professions such that the resulting gains were statistically significant in all three years (See Table 2). Though they were less than the gains in knowledge of HIV/AIDS, these gains are still large: 4.86, 3.89, and 4.08 for 2006, 2007, and 2008, respectively. Remarkably, students in pharmacy in 2006 reported a knowledge gain of 5.59, well above the mean, which created a statistically significant difference when compared to medicine, nursing, and physical therapy ($F(4, 166) = 6.68, p < .001$). In 2007 and 2008 there were no statistically significant differences among programs.

Similarly, the results from the objective pre- and post-tests in 2007 also indicated that the students' knowledge of other professions increased from pre-tests ($M = 7.13, SD = 2.31$) to post-tests ($M = 8.68, SD = 2.12$) and was statistically significant ($t(259) = 12.30, p < .001$). This gain yielded a moderately large effect size (Cohen's d) of 0.70, which was less than the effect size calculated using the self-assessments ($d = .31$). Student comments illustrating knowledge gained about other professions included

PBL groups help with team work as well as in gaining of understanding the role of different healthcare professionals.

I feel this experience was quite effective and valid. Often as new grads working we are not aware of everything other professions have to offer. I feel this has helped increase my awareness of other disciplines.

Student satisfaction

The factor analysis of (758) student satisfaction surveys yielded three categories: usefulness, enjoyment, and facilitator effectiveness (see Table 3). For all items, responses ranged from 0 (Strongly Disagree) through 6 (Strongly Agree), with 3 indicating "Don't know." An option of "Not Applicable" was also available. "Usefulness" consisted of seven items from the survey related to motivation, rewards, relevance, and worth of various aspects of the PBL module. This factor was found to be internally consistent ($\alpha = .77$). The "Enjoyable" variable was composed of five items and addressed student enjoyment with the PBL module. This variable was internally consistent ($\alpha = .83$). "Facilitator Effectiveness" was the combination of two items that asked about facilitator skill in guiding group process and facilitator effectiveness. This variable possessed a high degree of internal consistency ($\alpha = .95$).

Usefulness. Student responses indicated that they found the iPBL module on HIV/AIDS to be moderately useful over the years with an overall total of 4.32 (on a scale of 1-6). There were few remarkable statistically significant differences among professions. Student comments reflecting the usefulness of PBL sessions included

I found it very useful to work with other healthcare professionals.

It helped with informing me how the process of "working together" goes, and being able to communicate with each other.

Table 3:

**Student satisfaction: Usefulness, enjoyment,
and facilitator effectiveness***

Years for which data are available	Usefulness* M (SD)	Enjoyment** M (SD)	Facilitator effectiveness M (SD)
2002 (PT)	-	5.07 (.87)	-
2003 (PT)	-	5.46 (.64)	-
2005 (PT, Med., Pharm.)	4.43 (.71)	5.24 (.66)	-
2006 (PT, Med., Pharm., Nutr, Nursing)	4.57 (.67)	5.25 (.63)	-
2007 (PT, Med., Pharm, Nutr, Nursing, Clinical Psychology, Social Work)	4.17 (.95)	5.19 (.75)	4.81 (1.18)
2008 (Med, Pharm, Nutr, Nursing, Social Work)	4.17 (.93)	5.02 (.70)	4.83 (1.34)
Total	4.32 (.86)	5.19 (.70)	4.81 (1.23)

*6-point scale with higher scores reflecting greater satisfaction

ANOVA

* $F(3,684) = 9.94, p < .001$

Post Hoc

2005-2007, $p = .016$ 2006-2007, $p < .001$ 2006-2008, $p = .001$ ** $F(5,737) = 2.80, p = .016$ 2003-2008, $p = .029$

Students, who did not find the PBL modules useful, commented that the process was unnecessarily long and not reflective of actual interprofessional collaboration, as illustrated by the following quotes:

I have had the opportunity to observe a real-life multidisciplinary team approach to a patient case and it played out in a much different (and better) manner.

The PBL process is very drawn out. I believe that there would be a more effective format that would be more efficient in meeting our learning objectives.

Enjoyment. Students rated the modules as highly enjoyable with a total score of 5.19. No statistically significant differences were noted among programs. Comments reflecting student enjoyment included

It was nice to be able to get out of the lecture style of learning. This was a refreshing change.

It was fun and informative.

Facilitator Effectiveness. Students perceived the facilitation to be moderately effective (total of 4.81). No statistically significant differences were found among programs. The majority of students, who left comments, thought that the PBL facilitators were effective, as illustrated in the following comments:

Tutor did a fantastic job as facilitator; good balance between giving direction and providing information.

She was knowledgeable and let us work together and encouraged group participation!

She was very thorough and kept us on topic.

Although a majority of students was satisfied with their facilitator, dissatisfaction with facilitation reflected the desire for either more or less guidance from the facilitator. This is illustrated in the following quotes:

It would have been nice, though, if she was able to answer some (not all) of the questions we had i.e., those that were required to move forward during the PBL session.

I would like it if we were more independent and the facilitator only helped when she saw a struggle.

Discussion

Through the retrospective self-assessments students signalled that they increased their knowledge of HIV/AIDS and of other professions by about 60%, and 40% respectively (Table 2). That translates into large effect sizes ranging from 2.94 to 3.19 and 2.31 to 2.55. These self-assessments are moderately supported by an objective measure of learning, the case-based pre-test/post-test, with effect sizes of 1.12 and 0.70, respectively. Though the magnitudes of the effect sizes obtained from the two sources of data are different they do have some similarities. First, they are both positive though admittedly of different magnitudes. Second, the relative learning of HIV/AIDS compared to the role of other professionals is somewhat similar in both situations: the evidence is consistent that more was learned about HIV/AIDS than about the other professions.

The effect sizes from self-assessment data and other more objective sources in other studies [31] were much closer in size than they were in this study. We believe that the large difference in effect sizes could at least be due partly to the lack of time and attention devoted to the post-iPBL case questions. The sessions were held on Friday afternoons, and perhaps students were tired and wanted to get away for the weekend rather than conscientiously complete the post-test. Student written comments consistently complained about having sessions on Friday afternoons. Since the post-iPBL case questions did not count for marks or any kind of personal assessment it is possible that students did not invest the time and effort into carefully completing them to truly demonstrate what they had learned. In the future, we will consider including the post-iPBL case questions as part of an individual mark. Furthermore, the self-assessment questions were broader and more inclusive than the pre- and post-test case questions. We believe that the students learned much

more than what could have been captured by the pre- and post-test and naturally their self-assessments would be higher than what might have been indicated on the pre- and post-test.

The overall strong results should not be surprising since this module consists of about six hours of small group work and a few hours of independent research and discovery learning, a considerable amount of total time on task. This sizable amount of learning may be further explained in that the students knew very little about the care and management of people with HIV/AIDS before engaging in this module, so even a moderate change in absolute quantity of knowledge would appear to be a relatively large increase. Nevertheless, this will likely be the case for most situations when novice learners are confronted with a new topic or area of inquiry. What is not known is 1) whether some other intervention or series of interventions of the same length might make more learning possible, or 2) if the same amount of learning might be achieved through less time on task (a suggestion a few students made over the years), and 3) the relative contribution of the various elements of the iPBL module to student learning and satisfaction, not just that students learned generally, or that they learned better from iPBL than some other method. These lines of research need to be pursued to begin to answer these emerging questions.

The low self-assessment of learning about HIV/AIDS by medical students in 2006 was likely due to the fact that the 10 students (all volunteers; see Table 1 for more details on the evolution of the participation of medical students) were in their third year and had taken a course where caring for persons with HIV/AIDS had been taught. In the following years, 2007 and 2008, the medical students who participated were just beginning their second year, and they rated their knowledge gain from this module approximately 65% higher than that of the third-year students from the year before, a statistically significant difference. This difference demonstrates known-groups content validity [33] for the self-reported measure of knowledge of HIV/AIDS, since medical students who had not learned about HIV/AIDS reported greater gains in knowledge after completing the module than students who had taken a course on HIV/AIDS. Furthermore, the medical students from 2006 through 2008, in contrast to the differences for knowledge gained about HIV/AIDS, showed no statistically significant differences in self-assessed gain in knowledge of other professions. This finding, too, contributes to known-group content validity for the self-assessment of knowledge.

Self-assessments and the pre- and post-tests both revealed that students learned more about HIV/AIDS than about interprofessional teams and the roles of other healthcare professionals. This may be related to the phenomenon that the base level of knowledge about the roles of other healthcare professionals was greater than that for HIV/AIDS. The explanation might simply be that they actually learned more because they directed their attention to the scientific, medical, and technical aspects of the disease and less attention to the interprofessional dimension. This may be neither a good nor a bad phenomenon, but could be judged based on the intended and desired relative values of the two central learning goals. Curiously, students generally expressed satisfaction with the interprofessional

nature of the iPBL module and what they were learning about other professions, even though they reported learning more about HIV/AIDS than they learned about other professions.

There has also been a slow, but steady and statistically insignificant, decline in scores on the perceived usefulness and enjoyment of iPBL between 2006 and 2008. This may be a result of saturation with IPE as the number of these experiences for many health sciences students greatly increased at the University of Saskatchewan during this same time period. However, without more data and further exploration and research, it is not prudent to generate any firm conclusions as to the cause of this potential trend.

Overall, the modules have been rated moderately high (4 to 5 on a scale of 6) with “enjoyment” around 5 and “usefulness” closer to 4. Although there have been many suggestions for improvement, students appear to be relatively satisfied with this module. Perhaps it is unrealistic to expect higher satisfaction ratings because this module is mandatory, embedded within conventional curricula, and involves students from many diverse backgrounds and programs. Furthermore, PBL is a very different method of learning compared to conventional methods with which they may be more comfortable. Students have complained about the slow pace of the iPBL, a perceived over-emphasis on process concerns, and working on Friday afternoons (the only time during the week when students from all programs were not already scheduled into classes), issues that should receive some attention. Resolution of these factors may affect the ratings favourably.

We believe that iPBL modules, generally, could be worthwhile learning activities in other locations in the same way that classical PBL has been used successfully in many places and even diverse programs. There is no reason to think that the students and context at the University of Saskatchewan are so unique that iPBL would not work in another post-secondary institution as it has at this location. There are, nevertheless, several limitations.

One limitation of this study is the outcome data. First, the pre-test/post-test design needs to be stronger. Further research is needed in this area to establish both the validity of the method and the consistency of the results. Although pre-test/post-test methodology is widely used to assess the impact of programs [34,35], it is unclear what effect allowing participants to view their unmarked pre-test responses when completing the post-test might have. Studies could investigate whether post-test responses differ for those who view their unmarked pre-test responses compared with those who do not.

Second, the use of self-assessments should be validated repeatedly. Though there is evidence that self-assessments can be valid measures of outcome data, more research is needed.

Third, iPBL needs to be compared with a control group that uses a plausible alternative, perhaps other forms of iPBL, to determine the elements and features that contribute to success. iPBL incorporates elements of cooperative and experiential learning but further research is needed to help identify the contributions that each learning approach makes to the success of this iPBL module [24].

Finally, this study needs to be replicated at other institutions with different student groups and different curricula. In particular, this research has involved short term iPBL student groupings (one module of only 3 sessions) so may not be easily compared to the experiences of institutions where students may spend more time working together in iPBL teams or work together in multiple modules. These limitations should be addressed in further research.

This article describes the implementation of a successful, large scale, compulsory, iPBL module involving up to seven different generally conventional health professions programs and 300 students. iPBL should be further researched as it appears to be a promising approach to IPE and therefore ought to be seriously considered for implementation at other educational institutions.

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Appendix A

Learning Objectives and Sample iPBL Case Materials

Learning Objectives

The student will

- Identify and discuss relevant biomedical and psychosocial (i.e., humanistic) considerations relevant to the care of persons living with HIV/AIDS.
- Demonstrate competency in discussion of etiology, prevention, pathophysiology, natural history, testing, and prognosis of the disease.
- Describe basic healthcare management of HIV/AIDS.
- Redefine and explain HIV/AIDS as a lifelong chronic and episodic disease within a broad treatment and rehabilitation framework.
- Describe the roles of various healthcare professionals in the care, treatment, and support of persons with HIV/AIDS, and explain the importance of interdisciplinary collaboration in the management of the disease.
- Justify proposed assessment and treatment choices/options for Ginni, having considered quality of life issues and expected outcomes of patient care.
- Explain the impact of HIV/AIDS on the individual, family, workplace, health system, and society.
- Understand how to access community resources for individuals with HIV/AIDS.
- Contribute to the effectiveness of the team in this small group PBL environment.
- Display attitudes, skills, and behaviours that promote interdependent and self-directed learning.

Student Material for Day 1**Day 1 – Page 1**

- You are members of a healthcare team at the West Side Clinic.
- Ginni is a 40 year-old woman. She is divorced and has three children, aged 13, 15, and 17. She was diagnosed as HIV positive 8 years ago.
- Recently, Ginni has been finding it difficult to walk. Ginni describes her main problem as shooting pain and hypersensitivity in her feet and legs.
- Ginni has come in to the Clinic today to talk about these symptoms and some other concerns.

Day 1 – Page 2

- She says that she cannot sleep at night because her feet are “driving her nuts” and that even wearing socks and shoes “hurts too much.” She has fallen twice in the past week, once while stepping off a curb and once while walking on loose gravel. She feels anxious and exhausted, and says, “I can’t stand this much longer.”
- On observation, she demonstrates antalgic gait, and there is a red-dish-purplish hue to the toes of the right foot, in keeping with the appearance of a burn. She reports difficulty managing stairs, and decreased exercise tolerance. She is pale and thin in appearance.
- Ginni feels that her health has been deteriorating. In the past six months, she has experienced increased fatigue and has had to deal with recurrent episodes of impetigo, vaginal candidiasis, and respiratory infections. She has a persistent dry cough, which started 2-3 months ago and is getting progressively worse.
- Ginni’s height is 165 cm (5’5”) and her weight is 54 kg (119 lbs.).
- Six months ago, she weighed 57 kg (125 lbs.).
- Ginni recently started ‘highly active antiretroviral therapy’ (HAART). At the time therapy was prescribed her CD4 count was 225 cells/mm³ and plasma viral load 40,000 HIV RNA copies/mL.
- Ginni says that she is extremely worried that she might now have AIDS. She also confides that a close friend is at St. Paul’s Hospital on the Palliative Care Unit, dying of AIDS. She is finding this extremely hard to deal with.
- Your team diagnoses Ginni’s problem with her feet and legs as distal symmetrical polyneuropathy.
- Your team gives Ginni a requisition for relevant blood work.
- Ginni is scheduled to come back for further assessment and possible health teaching next Tuesday at 10 a.m.

Appendix B**HIV/AIDS Student Evaluation Survey**

1. I was motivated to seek information between sessions.
2. Finding the information to solve the problem was rewarding.
3. What I learned is pertinent to my future career.
4. It was challenging to find the information needed to understand this situation.
5. This PBL process required me to apply what I knew about the practice of my chosen profession.
6. I was pleased with what the other students contributed to the PBL group.
7. As a result of this exercise my understanding of HIV/AIDS has increased.
8. I enjoyed working with students from the other programs.
9. I was comfortable working with students from the other programs.
10. The PBL experience was one of mutual respect and collaboration among different programs.
11. The PBL experience with other programs was worthwhile.
12. My group facilitator was skilful in guiding the group process.
13. Overall, my group facilitator was effective.
14. Using the scale below, please rate the overall group process in your tutorials.*

Consider the extent of your CURRENT knowledge of HIV/AIDS and the services available in Saskatoon to support people in this situation to be 9/9. Indicate using a number between 0 and 9 what your knowledge level was before beginning this inter-professional PBL module.

Consider the extent of your CURRENT knowledge of what other disciplines can bring to the care of HIV/AIDS patients/clients to be 9/9. Indicate using a number between 0 and 9 what your knowledge level was before beginning this inter-professional PBL module. (*Note: In 2006 students were asked to indicate a number between 1 and 10.*)