Preprint: "Effectiveness and student perceptions of high-enrolment health studies online courses" to appear in *Health Education Journal*

Chen, K-Z., Lowenthal, P. R., & Bauer, C. (2015). Effectiveness and student perceptions of high-enrolment health studies online courses. *Health Education Journal*.

Effectiveness and student perceptions of high-enrolment health studies online courses

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Abstract

Objective: In countries such as the USA, colleges and universities are focusing on how best to serve their students in tough fiscal times and a highly competitive marketplace. Boise State University has specifically focused on providing online courses as one option to meet student needs. However, more recently, Boise State began developing high-enrollment online courses to resolve bottlenecks in enrolments, while maintaining robust, interactive, and engaging learning experiences.

Design: A mixed-method case study.

Setting: Three high-enrollment health studies online courses offered at a 4-year university in Boise, Idaho, USA.

Method: A systemic analysis of final course evaluations, student grades, and course reports from the Learning Management System were examined to investigate the effectiveness and student perceptions of high enrolment online courses.

Results: Findings provide support that offering the high-enrollment courses met enrollment demand, provided quality instruction, and maintained student satisfaction.

Conclusions: We present student perceptions of three high-enrolment health studies online courses. Lesson learned and suggestions for faculty members, instructional designers, and administrators are provided along the way.

Keywords
High-enrolment online course, health education, online course development

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Introduction

State funding for institutions of higher education has decreased dramatically during the past decade (Liefner, 2003; Zusman, 2005). The State of Idaho, like many other states in the USA as well as countries abroad, is struggling to fund higher education at pre-recession levels. At the same time, many institutions of higher education (IHE) have witnessed an increased demand for online courses (Allen and Seaman, 2013). Online courses are no longer only for non-traditional, full-time working students. Research suggests that all types of students, even a typical 18 year-old first year, are now taking at least one online course (Allen and Seaman, 2013; Radford, 2011). As a result, IHE have begun experimenting with ways to meet the growing demand for online courses. A common approach is to increase the number of courses offered online (Jaggars, 2014). However, another approach is to focus an institution's limited resources on courses with high-enrollments (Bolliger and Wasilik, 2012; Liu and Cavanaugh, 2011). Offering high-enrolment courses online however presents a number of possible challenges. The purpose of this study was to examine the effectiveness and student perceptions of high-enrolment health studies online courses. We present the results of our inquiry into student enrolment, achievement, retention, and end-of-course evaluation data for three high-enrolment health studies online courses at Boise State University between autumn 2012 and summer 2013.

Background

The demand of high-enrollment online courses

Student enrolment at Boise State University has increased about 40% over the last decade. For instance, the number of on-campus students nearly doubled from 4,805 to 9,207 between 2009 and 2010 (Distance Education at Boise State 2000-2010, 2010). Rapid growth like this presents challenges for instructional units when they have to schedule classes, allocate classroom space, and assign instructors to teach specific courses. Growth like this also becomes problematic when it creates "bottlenecks" with core courses because students' academic progress can be delayed, which in turn can negatively influence when they graduate (e.g., Helliker, 2011). Time to graduation is a nationwide problem in the USA (Idaho State Board of Education, 2011). Boise State University, like many universities, is interested in finding ways to support students to accomplish their educational goals in a timely manner (Boise State University Strategic Plan 2012-2017, 2012). Therefore, when faced with increased enrolments and possible bottleneck courses, the university began converting high-enrolment courses at the undergraduate level into an online format.

Challenges in offering high-enrollment online courses

University teaching faculty often assume that larger courses are not as effective as smaller courses (e.g. Twigg, 1999) and that technology can actually create additional challenges in larger courses. For example, faculty members report that it is more difficult to meet individual learning needs and maintain student engagement in large online classes (Scholl and Thomas, 2012). Further, instructional tasks like grading can become unmanageable in high-enrolment online courses. Faculty also report feeling conflicted about regularly giving redundant feedback in the discussion boards of large online courses (Rowe, 2011). The health education literature also reports specific challenges in large online classes. For instance, maintaining student-teacher contact (Diekelmann and Mendias, 2005), mentoring students (Mancuso-Murphy, 2006), supervising competence-based exams (Thiele, 2003), and fostering interaction and collaboration (Raines, 2007) are just a few of the challenges reported in the literature. Despite challenges like these, Johnson (2012) argues that offering large, lower-division, high-enrolment courses online is here to stay because it resolves bottlenecks and provides students increased flexibility. Therefore, the question is not whether or not to offer high-enrolment online courses but rather how IHE can properly address potential challenges while still maintaining the quality of education (Bolliger and Wasilik, 2012).

Institutional consideration and support

Nursing and health science educators have delivered courses to distance students for decades (Billings, 2007; Kelly, 2014). In the State of Idaho, graduates in the health care professions are in high demand, and enrolments in health care programs continue to grow (Distance Education at Boise State 2000-2010, 2010; eCampus Strategic Plan, 2012; Educause, 2011). To help address student demand and future program development, the university identified three bottleneck courses to redesign in a high-enrollment fully online format: HLTHST101: Medical Terminology, HLTHST300: Pathophysiology, and HLTHST304: Public Health. These courses were chosen because they are foundational health studies courses in high demand with a history of long waiting lists. A design team, consisting of faculty and teaching assistants in the College of Health Sciences and instructional designers in the eCampus Center, collaboratively designed and developed high-enrolment online versions of these three courses in the summer of 2012. A lead faculty member was assigned to each course. Each lead faculty member received one stipend to develop the course and a second stipend to support action research on the course after it was taught. In addition, an expert in Blackboard[1] provided consultation on possible technical issues with offering high enrollment courses during the development and teaching of these three courses. To improve course quality, each course was evaluated by instructional designers using the Quality Matters™ rubric (i.e., a rubric of 8 standards used to evaluate the design of online courses, see also MarylandOnline, 2011) before each course was offered for the first time in the autumn of 2012; each course was then reviewed again using the Quality Matters™ rubric by Boise State University faculty members before each course was offered the second time in spring 2012.

Course re-development and implementation

A standard course template with consistent navigation was developed to improve teaching faculty and student experience in these high-enrolment courses. The standard course template included the following components:

- Syllabus outline,
- A "Getting Started" folder,
- Structured weekly folders for each module (that included weekly checklists with due dates, reading/resource, activities, and quizzes/exams/assessments).

Standardisation helps students quickly become familiar with what was required of them each week (Cicchino, 2008; Huun & Hughes, 2014). However, each course was also modified in intentional ways to address large enrolments in an online environment.

Medical terminology Course

This course historically involved long lectures. However, long lectures can become problematic online (Lord, 2013). Therefore, the long lectures previously used in this course were chunked into shorter, manageable videos for the students to watch and re-watch as needed. Multiple assessment strategies were used to keep large numbers of students on track. Participation was required and graded but students were allowed to choose how they earned their participation points. For instance, after reading an assigned case-study journal article, students could choose to attend live synchronous sessions using Blackboard Collaborate[2] or instead post responses about the article in a discussion board facilitated by teaching assistants (TA). Students also had to complete low-stakes quizzes each week. These quizzes allowed faculty to monitor student progress while also providing students with automated but timely feedback (Anderson and Provant-Robishaw, 2013). Students also completed three examinations on Blackboard (the LMS used) throughout the semester.

Pathophysiology Course

When converting Pathophysiology to a high-enrolment online course, the design team focused on increasing

[1] Boise State University uses Blackboard Learn ® as her online platform for course delivery.
[2] A synchronous course-meeting tool provided within the Blackboard Learn.

interaction with students, re-organising the course content, chunking chapter lectures, and building interactive questions with automated feedback. To help manage instructor workload, quizzes, study guides, and discussion boards were designed to be self-graded. This in turn enabled the instructors and TAs to focus their time on student-to-teacher interactions. The design team (i.e., the lead faculty, TAs, and instructional designers), though, spent most of their time on scaffolding student learning, which included adding module overviews and checklists, technical instructions for using specific tools in Blackboard (e.g., wikis), chapter quizzes, study guides, lecture slides, journal articles, and so on.

Public health Course

In previous semesters, Public Health was offered as a self-paced (heavily text-based) online course. The design team began by reviewing and aligning the existing learning activities and course/module objectives and creating a "Course Design Map" (Turco, 2014). Then the design team of Public Health focused on creating lecture videos using Echo 360 (the PowerPoint lecture video system). Finally, the design team re-wrote the initial communication with students to emphasise that this course was not a self-paced, self-study course.

Method

The purpose of this study was to examine the effectiveness and student perceptions of three high-enrolment health studies online courses offered at Boise State University between autumn 2012 and summer 2013. More specifically, this study aimed to address the following questions:

1. What is the enrolment and retention of these three health studies high-enrolment online courses?
2. How well do students learn in these three online courses?
3. What are students' perceptions taking these three online courses?
4. What lessons can we learn from re-designing, re-development, and teaching of these three online courses?

Blackboard Course Reports, final course evaluations, and student grades from each course between autumn 2012 and summer 2013 were used to answer these research questions. Using SPSS 21.0, quantitative data were analysed with descriptive statistics to explore the overall picture of these three courses. Inferential statistics were then used to test the difference between student achievement and course evaluations across multiple delivery formats and semesters. Using NVivo 10, open-ended student feedback from the final course evaluations was coded into meaningful categories to support the explanation of effectiveness as well as to capture student perceptions of the three high-enrollment online courses. Finally, working documents—such as instructional designers' meeting notes and faculty members' reflections—were also collected to portray the course development and improvement process. All identifiable information was removed prior to the analysis.

Results and Discussion

Enrolment and retention

Student retention in online courses remains an issue for faculty and administrators (Bolliger and Wasilik, 2012). In the autumn of 2012, the first semester these new courses were offered, 743 students enrolled in these three courses (see Table 1). Of these 743 enrolments, 565 students passed the courses, resulting in a 79.7% retention rate. The pass rate for those students, who persisted in the autumn of 2012, was 94.9% (for Medical Terminology), 95.6% (for Pathophysiology), and 95.6% (for Public Health), or 95.4% across all three courses. The typical face-to-face class size of these three courses was 45 students.

[Table 1 about here]

In the autumn of 2012, the high-enrolment online section of Medical Terminology had 262 students compared to three on-campus sections that had 28, 89, and 45 students. The high-enrolment Medical Terminology course continued to attract high enrolments, with 240 students in the following spring 2013 semester. Similarly, the re-designed high-enrolment online section of Pathophysiology enrolled 304 students in the autumn of 2012 and 286 students the following spring. Finally, the enrolments in Public Health in the autumn of 2012, were 44 students for the on-campus section and 91 students in the high-enrolment online section, which then increased the following semester to 104 students in the high-enrolment section compared to only 43 students in the on-campus section. To summarise, these high-enrolment online sections were able to double, if not at times triple, enrolments in these courses compared to the traditional face-to-face sections. The College of Health Sciences was able to meet students' demands without reallocating faculty resources from research, teaching, and service tasks with these new high-enrolment online courses.

Learner achievement

Increasing enrolments though is only part of the challenge. Faculty and administrators want to ensure that students are still learning what they need to learn in high enrolment courses. In the autumn of 2012, the first semester these courses were offered, 95% of students passed each of these courses. In fact, 60% of the students in Medical Terminology, 47.7% in Pathophysiology, and 61.5% in Public Health earned an "A". Instructors of these three courses had different foci in terms of the balance between student effort versus achievement. For example, the faculty member teaching Pathophysiology was interested in how students themselves expected to perform in the course. Thus, this faculty member compared students' confidence at the beginning of the semester (collected with a pre-course survey) to students' academic progress and final grade at the end of the semester. Results revealed that students tended to overestimate their performance by one or more grade steps. For example, a student might estimate that he or she would get an "A" in the course, when in fact he or she actually ended up completing the course with an A- or B+. At the same time, while students were expected to spend 12-16 hours each week on the course, 63% of these students reported studying less than 12 hours.

The faculty member teaching Medical Terminology was interested in analysing how students performed across course formats. In other words, did students in the high-enrolment section perform as well as students in the on-campus section? The Medical Terminology course was offered as a face-to-face course in autumn 2011, as a hybrid course in spring 2012, and as a high-enrolment completely online course in autumn 2012. A chi-square test was conducted to see if any differences existed in terms of letter grades across three semesters. Findings revealed a significant difference (X^2= 16.02, df = 8, p=0.042). Interestingly, students in the online section earned fewer grade Bs than students in the on-campus section (see Table 2). This suggests that in the online section, student performance seemed to be polarised. Some students may have benefited from the flexibility and individuality of the online environment and in turn earned better grades, while others earned lower grades, possibly due to the lack of support when learning online. In this regard, additional instructional supports such as online tutoring services may be necessary to help ensure that all students are successful in high-enrolment online courses.

[Table 2 about here]

Course evaluation and student feedback

Literature suggests that some common challenges of designing and delivering high-enrollment online courses includes keeping students engaged and on track (Sheppard, 2005) and carefully assigning proper homework to prevent overload and dropout (Johnson, 2012). The authors used the campus-wide end-of-course evaluation to investigate student perceptions of these new courses. The end-of-course evaluation asked students a series of questions, on a 5-point Likert scale, about their teaching and learning experience as well as overall

satisfaction with a given course. Table 3 summarises the overall course evaluation results in course preparation, assessment, instructor fostered student learning, and course content for Medical Terminology, Pathophysiology, and Public Health in autumn 2012. For Medical Terminology and Public Health, students expressed high satisfaction in all areas and their overall ratings were higher than departmental averages. For Pathophysiology, students expressed moderate satisfaction and wider standard deviation. With instructors' permission, the raw data of course evaluations were obtained from previous semesters of each course to examine differences in students' feedback before and after the course re-design.

[Table 3 about here]

Medical Terminology Course

This course had the same content with the only one difference being the format of delivery. Therefore, a multivariate analysis of variance (MANOVA) was used to test the response differences of the course evaluation results across four semesters (different formats). The results revealed that students' satisfaction across four semesters (autumn 2011, spring 2012, autumn 2012, and spring 2013) was statistically different ($p=0.00$). The follow-up ANOVA test indicated that there were different opinions across semesters in some of the questions. The Sheffe method of *post-hoc* comparison was applied to explore the significant mean differences in each item across the four semesters. The following summarises the results:

1. Perceiving instructor's enthusiasm for teaching and explaining the course structure in on-campus classrooms was thought to be easier than online. However, online students in spring 2013 perceived the same level of instructor enthusiasm and higher clarity of course structure than those who sat in the on-campus section (autumn 2011).
2. Comparing the two high-enrolment online sections, students perceived higher learning encouragement from the instructor in spring 2013 than in the autumn 2012.
3. Spring 2013 online students perceived the instructor's preparation was as good as previous on-campus sections. They also reported that the assessment requirements were more clearly stated and that the learning materials were better explained in the online section compared to the on-campus section.

Students in both the online and on-campus sections of Medical Terminology demanded individual attention and held high expectations of their instructors. After a careful revision, the spring 2013 course evaluations showed that students were as satisfied with the high-enrolment online section as the previous on-campus section of Medical Terminology (see Figure 1).

[Figure 1 about here]

Pathophysiology Course

In terms of students' satisfaction overtime, there appeared an initial drop between the on-campus section (spring 2012) and the first-time delivery of the re-designed high-enrolment online Pathophysiology (autumn 2012). However, students' satisfaction gradually increased in spring 2013 to the same level as the previous on-campus sections after the navigation of the online course was improved and the faculty member teaching the course became more comfortable teaching online (see Figure 2). A MANOVA was run to test for statistical differences across four semesters; it revealed significant differences ($p< 0.00$). The results show that students' opinions across the four semesters (spring 2012, autumn 2012, spring 2013, and summer 2013) were significantly different. The *post-hoc* comparison showed that student satisfaction in spring 2013 and summer 2013 were both greater than in autumn 2012.

[Figure 2 about here]

Public Health Course

Unlike the other two courses, Public Health was a self-paced online course in spring 2012. After the redesign,

student satisfaction slightly increased in autumn 2012, spring 2013, and summer 2013. A MANOVA was used to test the response differences of the course evaluation results across semesters. Although Figure 3 shows a slight increase in student evaluations of the course over time, the MANOVA revealed that these differences were not statistically significant (P=0.337) in terms of student satisfaction among four semesters.

[Figure 3 about here]

To summarise, overall instructors experienced some drops in their course evaluations the first time they taught a high-enrolment online course. However, as instructors became more comfortable teaching large online courses and used these evaluations to improve the delivery of their course, their course evaluations gradually increased back to the levels they had previously had in the face-to-face sections.

Open-ended response

Student feedback was also collected from the open-ended survey questions for each end-of-course evaluation. Qualitative data was compiled and imported into NVIVO 10. Initial exploratory analysis of the data was conducted by text cloud analysis and the result revealed that the terms "time", "works", "learning", "courses", and "schedule" were frequently used by students. Students expressed concern about delivery format, time allocation, scheduling, workload, and assessments. Students reported though that they appreciated the flexibility of taking online courses. However, they also expected 24/7 support to be available to them in order to meet their learning needs but did not know where and how to obtain technical support (e.g., where do they get support for updating the Java plug-in to participate for Blackboard Collaborate). In addition, some students were confused by inconsistent messages between instructors teaching the courses and TAs assisting instructors in each course; conflicting messages made it difficult to understand the expectations of group activities in a large online class. Students expressed appreciation that the instructors and TAs were responsive and always willing to help. However, interaction became most challenging in online sections with more than 200 students. Across all three courses, students mentioned that the cognitive learning scaffolds, like study guides and self-evaluations, were particularly useful when they did not know how to make sense of their own learning or how to plan their own pace of learning.

Scheduling and individuality concerns were also revealed from the open-ended feedback. Non-traditional, working students commented that course schedules needed to be carefully reviewed. For example, Friday evening due dates for assignments were problematic for most working adults who preferred to resume learning over the weekends. Similarly, Blackboard Collaborate sessions scheduled during normal working hours prevented some working students from participating. On the contrary, some traditional students indicated that they preferred face-to-face learning whenever possible. For students who preferred face-to-face courses but registered in online sections, the synchronous Blackboard Collaborate sessions somewhat relieved their frustrations. At the same time, though, a significant proportion of Medical Terminology students were working adults in the medical industry; these students indicated that taking Medical Terminology online individually was actually easier than taking it face-to-face because they used these terminologies day-to-day. However, that same course was very difficult to undergraduates who had no prior exposure to the subject (i.e., much like learning a new foreign language).

Lessons Learned

The results of our inquiry, coupled with the personal experiences of those directly involved in this project, revealed a few key lessons learned for health studies faculty, instructional designers, and administrators involved with high-enrollment online courses.

For faculty

Prior to delivering a high-enrollment online course, teaching faculty should consider the following issues:

1. **Recognise potential workload increase in both teaching and designing.** Faculty often report that it takes more time to teach online courses than face-to-face courses (Hummer, Sims, Wooditch, and Salley, 2010; Tomei, 2006). This difference in workload can be amplified when teaching high-enrolment online courses. Burn out can occur very quickly and staff should therefore plan for additional time both during the design and development phase of the course as well as during the first few semesters teaching the course. Balancing one's teaching load (e.g., teaching no more than one high-enrolment online course a semester) may prevent faculty burnout and increase faculty buy-in over time.
2. **Provide learning scaffolds.** Students reported that the test-taking tips and study guides provided in their courses helped them succeed in these high-enrolment courses. Learning scaffolds like these can be introduced in lesson overviews, learning activities, and test reviews to facilitate self-directed learning. Faculty need to keep in mind that just as teaching a high-enrolment course may be a different experience for them, taking a high-enrolment online course is a different experience for students. Therefore, additional supports can help students succeed in high-enrolment online courses.
3. **Re-think assessment to deter academic misconduct.** Some faculty members fear that cheating is more rampant and harder to detect in online settings (Briggs, 2013). Due to this fear, students in Medical Terminology were asked about the existence of academic dishonesty in the course evaluation. Students reported that they moderately agreed the existence of academic dishonesty (Mean = 2.91 out of 5, SD=1.13); some students also mentioned academic misconduct in their open-ended feedback. Health Science students, though, should commit to the highest standard of academic integrity given the nature of their life-saving professions (Jiang, Emmerton, and McKauge, 2013). Therefore, teaching faculty should strive to encourage academic integrity by applying authentic assessments, portfolios, and proctored exams in all high-enrolment online courses, but especially in health studies online courses.
4. **Build effective teacher-to-student communication.** One challenge with teaching high-enrolment online courses is dealing with possibly hundreds of student emails each week. Creating a Question & Answer (Q&A) forum, however, can reduce the number of emails faculty members receive (Kelly, 2014). Faculty members should also encourage students to answer other student's questions when they can. At the same time, faculty members should clearly define and communicate the roles of teaching assistants so that students know that they can contact TAs for housekeeping tasks (e.g. grading); this will enable faculty members to focus on student feedback and content-specific questions. Another way to control and improve teacher-to-student communication is through controlling the release of content. For instance, Blackboard has a tool called Adaptive Release. Faculty can use Adaptive Release (or similar tools) to ensure students read or complete certain tasks before moving on to other assignments (see Kelly, 2014). After careful improving the communication plan in Medical Terminology (with strategies like those mentioned above), the retention rate increased from 74.4% in autumn 2012 to 90.4% in spring 2013.

Instructional designers

When working with teaching faculty to design and develop high-enrolment online courses, instructional designers should consider the following:

1. **Understand the limitations of the Learning Management System (LMS) and seek alternatives when needed.** Instructional designers should spend time load testing their LMS, including each specific tool of their LMS, to ensure that it can handle courses with hundreds of (possibly simultaneous) users. More specifically, collaborative learning activities should be selected, designed, and load-tested carefully considering high-enrolment scenarios. Alternative and stable learning tools (e.g. Google Documents or Mediawiki) should be used when needed.
2. **Enhance learner readiness**. Not all students are equally prepared to take online courses (Dray, et al., 2011). Instructional designers should assume that technical issues will arise and find ways to direct

students to just-in-time technical support resources before contacting faculty for help. The syllabus should also clearly identify software and hardware requirements, the need for consistent and regular Internet connectivity, and finally any specific tools needed for the course. An optional "boot camp" experience before the beginning of the semester, such as online student orientations, may provide online students with the information and skills they need to successfully use the LMS. Another option is to add some non-graded or low-stakes learning activities during the first few weeks to familiarise students with the tools and provide them opportunities for practice before they must use the tools to complete graded assignments.

3. **Provide a bank of effective teaching strategies**. High-enrolment online courses often require different teaching strategies than regular online courses. Therefore, instructional designers should identify a list of teaching strategies that work well with them. The following teaching strategies were successfully used in the three courses used in this study:
    a. Start with small group activities to build student confidence before implementing large-group activities (Wiesenberg and Massey-Hicks, 2005).
    b. Use discussions, both asynchronous and synchronous, to provide guidance and explanations throughout the class.
    c. Respond selectively to student posts. Rephrase and make connections between student postings to convey responsiveness and teaching presence.
    d. Incorporating self- and peer-assessment activities, audio-feedback to students' assignments instead of time-consuming written feedback (Kelly, 2012), and enlist good students as discussion facilitators and/or informal TAs to help facilitate the course.
    e. Engage students in deliberate practice like disciplinary experts. For example, in health studies courses, you can use real-world hospital scenarios as topics of debate help students begin thinking like nursing practitioners (Kelly, 2014).

Administrators

Finally, based on the lessons learned from this study, academic departments and institutions should investigate and ensure the following faculty and student supports are in place prior to offering high-enrolment online courses:

1. **Provide additional compensation.** A survey of 61 institutions from Education Advisory Board (2010, cited in Scholl and Thomas, 2012) revealed that most institutions do not provide extra compensation for instructors who teach high-enrolment classes. Since teaching a regular online course can often require more time than a traditional face-to-face course, and a high-enrollment course can double that workload, administrators should consider providing additional compensation or other incentives (e.g., a course release) to encourage faculty to design, develop, and teach high-enrollment online classes (Morrill and Geraci, 2011).
2. **Provide student supports**. It is impractical for faculty teaching high-enrolment online courses to meet all students' individual learning needs. Research from Riffell and Sibley (2005) revealed upper-division college students are more accustomed to study in large-enrolment online courses. Since many high-enrolment courses are lower-division first year courses, academic advising and technical support are extremely important to deliver these online courses successfully. In addition to assigning TAs based on enrolments, administrators may consider providing online tutors to hold virtual office hours and other virtual tutoring services. For instance, to control the costs of hiring graduate level teaching assistants (GTAs) on high-enrollment online courses, the University of Colorado Boulder in the USA used high performing undergraduate students who have completed the same course in a previous semester as non-grading undergraduate learning assistants (ULAs) to conduct tutor sessions (Lokken and Womer, 2007; Scholl and Thomas, 2012).
3. **Offer on-demand technology aids.** When offering high-enrolment online courses, the number of

students who need technical support increases dramatically. In our experience, just-in-time technical support is needed during the first two weeks of a semester to provide technical support and to ensure students are able to access and participate in the course in a timely manner.

4. **Establish a cap policy**. High-enrolment online courses are the not the same thing as non-capped, Massive Open Online Courses (MOOCS). Scholl and Thomas (2012) suggest that the cap on high-enrollment online courses should be based on the maximum number of students that still can ensure a high-level of interaction between the students and instructors, which in most cases is about 100 students. Additionally, the cap on high-enrolment online courses should not be higher than the cap for high-enrolment on-campus courses (Morrill and Geraci, 2011). With these guidelines in mind, an optimal way of offering high-enrolment online courses can be creating multiple course sections in which each section has a different focus based on student backgrounds. For example, instead of offering one Pathophysiology course online with 300 students who pursue different academic majors, a better approach may be to offer three different sections of Pathophysiology—each with a cap of 100 enrollments—in which each section is tailored for a different group of students (e.g., one section for Radiology majors, another for Nursing majors, and one for non-Health Science majors).

Conclusions, limitations, and recommendations

Offering these three health studies courses online was an invaluable learning experience for university faculty, students, and instructional designers. The results of our inquiry—namely, data concerning retention, learning achievement, and end-of-course evaluations—suggest that institutions can offer high-enrolment online health studies courses successfully. However, successful high-enrolment courses are not the result of chance. Continuous course improvement is required to design, develop, teach, and then improve high-enrollment courses. As the courses improved, so did the student retention rates and overall satisfaction.

There is one major limitation to this study. The researchers started to investigate the effectiveness of these three high-enrollment courses in spring 2013, which was after the initial delivery of the courses. Under such circumstances, the authors were not able to collect data equally to assess the effectiveness of the courses. Instead, the authors obtained each faculty members' permission to retrieve past data from the university systems (e.g. in the form of course evaluations and LMS records), and then de-identified this student data for analyses. However, instructors teaching these courses may not have kept detailed records for each semester, so the authors could only conduct selected in-depth analyses in the study.

Additional research is needed on high-enrolment online courses. From the findings, lessons learned, and limitation of this study, future research could investigate the optimal size of high-enrolment online courses by subject areas. Moreover, teaching strategies that increase students' interaction and engagement in large online class should be identified. Finally, a real-time learning analytics dashboard visually illustrating information about student progress and student retention should be included in the LMS in order for health education faculty to track and facilitate student learning in high-enrollment online courses.

References

Allen IE and Seaman J (2013) *Changing course: Ten years of tracking online education in the United States*. Babson Park, MA: Babson Survey Research Group and Quahog Research Group. Available at: http://sloanconsortium.org/publications/survey/changing_course_2012 (accessed May, 21, 2013).

Anderson J and Provant-Robishaw C (2013) Conversion of medical terminology course to high-enrollment online course. Paper presented at the *29th Annual Conference on Distance Teaching and Learning*, Madison, WI. 8-9 August.

Billings DM (2007) Guest editorial: Optimizing distance education in nursing. *Journal of Nursing Education,* 46: 247-248.

Boise State University (2012) *Strategic Plan 2012-2017*. Available at: http://academics.boisestate.edu/strategic-plan/ (accessed 12 August 2014).

Bolliger DU and Wasilik O (2012) Student satisfaction in large undergraduate online courses. *The Quarterly Review of Distance Education* 13(3):153-165.

Briggs L(2013) Keeping an eye on cheaters. In: *Campus Technology*. Available at: http://campustechnology.com/articles/2013/04/04/keeping-an-eye-on-cheaters.aspx

Cicchino, R., (2008). Getting the Best Out of Your Faculty with a Course Template. *Distance Education Report,* 12(1): 5-7.

Diekelmann N and Mendias EP (2005) Being a supportive presence in online courses: Knowing and connecting with students through writing. *Journal of Nursing Education* 44: 344-346.

Distance Education at Boise State 2000-1010 Report (2010) Boise, ID: eCampus Center at Boise State University. [Internal Report].

Hummer D, Sims B, Wooditch A and Salley KS (2010). Considerations for faculty preparing to develop and teach online criminal justice courses at traditional institutions of higher learning, *Journal of Criminal Justice Education* 21: 285-310.

Dray BJ, Lowenthal PR., Miszkiewicz MJ, Ruiz-Primo MA and Marczynski K (2011). Developing an instrument to assess student readiness for online learning: A validation study. *Distance Education* 32(1): 29-47.

eCampus Strategic Plan (2012) Boise, ID: eCampus Center at Boise State University. [Internal Report].

Educause (2011) *Find BSU strategic planning reports*. Boise, ID: eCampus Center at Boise State University. [Internal Report].

Helliker K (2011) High-enrollment strains two-year college. *Wall Street Journal.* Feb. 09, 2011.

Huun K and Hughes L (2014). Autonomy Among Thieves: Template Course Design for Student and Faculty Success. *Journal of Educators Online* 11(2): 1-30.

Idaho State Board of Education (2011) *Complete college Idaho: A plan for growing talent to fuel innovation and economic growth in the gem state.* Boise, ID: State Board of Education.

Jaggars SS (2014) Choosing between online and face-to-face courses. *American Journal of Distance Education* 28(1): 27-38.

Jiang H, Emmerton L and McKauge L (2013) Academic integrity and plagiarism: A review of the influences and risk situations for health students. *Higher Education Research and Development* 32(3): 369-380.

Johnson G (2012) *Can online learning scale without losing quality?* Available at: http://olc.onlinelearningconsortium.org/sites/default/files/SloanC_Oct2012.pdf

Kelly R (2012) Managing high-enrollment online courses. *Distance Education Report* 16(3): 4.

Kelly R (2014) Creating engaging, high-enrollment online courses. *Online Cl@ssroom* 14(3): 7-8.

Liefner I (2003) Funding, resource allocation, and performance in higher education systems. *Higher Education* 46(4): 469-489.

Liu F and Cavanaugh C (2011) High-enrollment course success factors in virtual school: Factors influencing student academic achievement. *International Journal on E-Learning* 10(4): 393-418.

Lokken F and Womer L (2007) The Pro's and con's of tutoring programs for high-enrolling distance education courses. *Distance Education Report* 11(12): 1-8.

Lord M (2013) Step Online in Style. *Prism*. November 2013. Available at: http://www.asee-prism.org/?s=online+graduate

Mancuso-Murphy J (2006) Distance education in nursing: An integrated review of online nursing students' experiences with technology-delivered instruction. *Journal of Nursing Education* 45*:* 252-260.

MarylandOnline (2011). *Quality Matters™ Rubric Workbook for Higher Education (2011-2013 Edition)*. Annapolis, MD: MarylandOnline.

Morrill M and Geraci L (2011) *Considerations for online course enrollment limits*. Washington, DC: Education Advisory Board.

Radford AW (2011) Learning at a distance: Undergraduate enrollment in distance education courses and degree programs. *Stats in Brief. NCES 2012-154*. Washington, DC: National Center for Education Statistics.

Raines D (2007) Using the Blackboard platform -- More than a course site. *Journal of Nursing Education* 46: 243-244.

Riffell S and Sibley D (2005) Using web-based instruction to improve large undergraduate biology courses: An evaluation of a hybrid course format. *Computers and Education* 44: 217-235.

Rowe F (2011) Strategies for managing larger online courses. Available at http://www.digitalpedagog.org/?p=560 (accessed Aug., 22, 2014).

Scholl J and Thomas A (2012) *Considerations for the structure of large online classes*. Washington, DC: Education Advisory Board.

Sheppard M (2005) Handling a high-enrollment hybrid course. *Online Cl@ssroom* 5*:* 3*.*

Thiele JE (2003) Learning patterns of online students. *Journal of Nursing Education* 42: 364-366.

Tomei LA (2006) The impact of online teaching on faculty load: Computing the ideal class size for online courses. *Journal of Technology & Teacher Education* 14 : 531-541.

Turco T (2014) Development of New Online Courses in Environmental Health. In: *International Environmental Health Faculty Forum*. Las Vegas, NV. 6 July.

Twigg CA (1999) *Improving learning and reducing costs: Redesigning large-enrollment courses.* Troy, NY: The Pew Learning and Technology Program.

Wiesenberg F and Massey-Hicks R (2005) Lessons learned from co-teaching a high-enrollment online course. *Online Classroom* Feb: 6-8.

Zusman A (2005) Issues facing higher education in the twenty-first century. In: Altbach PG, Berdahl RO and Gumport PJ (eds) *American higher education in the twenty-first century: Social, political, and economic challenges.* Baltimore, MA: Johns Hopkins University Press, pp. 109-150.

Table 1
Enrolment numbers of first offering of three high-enrollment courses in autumn 2012

Course	Initial Enrollments	Drop-outs	Remaining Enrollments (retention rate)	Passed (Pass rate)
HLTHST 100: Medical Terminology	262	67	195(74.4%)	185 (94.9%)
HLTHST 300: Pathophysiology	370	64	306(82.7%)	293(95.6%)
HLTHST 304: Public Health	111	20	91(82.0%)	87(95.6%)

Table 2

Summary of Chi-Square test of associations in the final grades of Medical Terminology

			Semester			Total
			Fa11 (on-campus)	**Sp12 (hybrid)**	**Fa12 (online)**	
Letter Grade	A	Count	106	118	117	341
		% of Total	18.6%	20.7%	20.6%	59.9%
	B	Count	52	24	39	115
		% of Total	9.1%*	4.2%*	6.9%	20.2%
	C	Count	15	21	23	59
		% of Total	2.6%	3.7%	4.0%	10.4%
	D	Count	5	4	6	15
		% of Total	0.9%	0.7%	1.1%	2.6%
	F	Count	11	18	10	39
		% of Total	1.9%	3.2%*	1.8%	6.9%
Total		Count	189	185	195	569
		% of Total	33.2%	32.5%	34.3%	100.0%

* $p < 0.05$

Table 3
Summary of Course Evaluation of Three High-Enrollment Online Courses in autumn 2012

Course	Response Rate	Course was well prepared	Instructor fostered student learning	Assessment method was well-explained	Course material was well-articulated
Medical Terminology	42%	M=4.39 (SD=0.84)	M=4.30 (SD=0.89)	M=4.00 (SD=1.16)	M=4.12 (SD=0.76)
Pathophysiology	82.7%	M=3.15 (SD=1.28)	M=3.19 (SD=1.25)	M=3.27 (SD=1.31)	M=2.97 (SD=1.29)
Public Health	93.4%	M=4.85 (SD=1.05)	M=4.70 (SD=0.87)	M=4.76 (SD=0.91)	M=4.29 (SD=0.94)

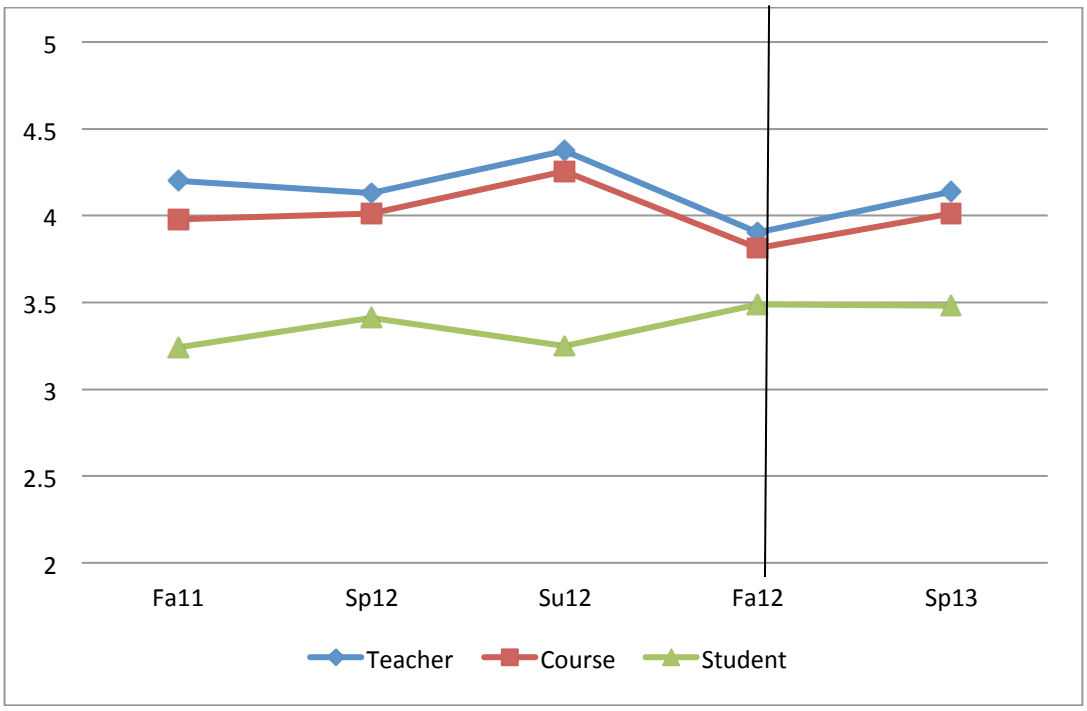

Figure 1. Multi-semester comparison of student satisfaction of teacher, course, and classmates in Medical Terminology.

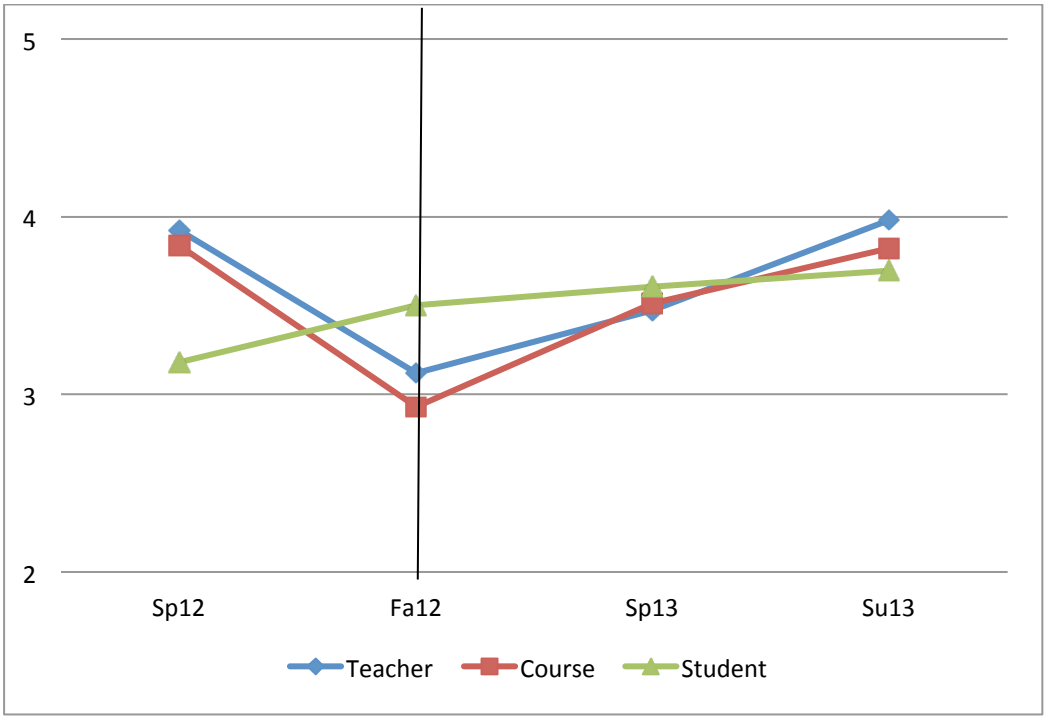

Figure 2. Multi-semester comparison of student satisfaction of teacher, course, and classmates in Pathophysiology.

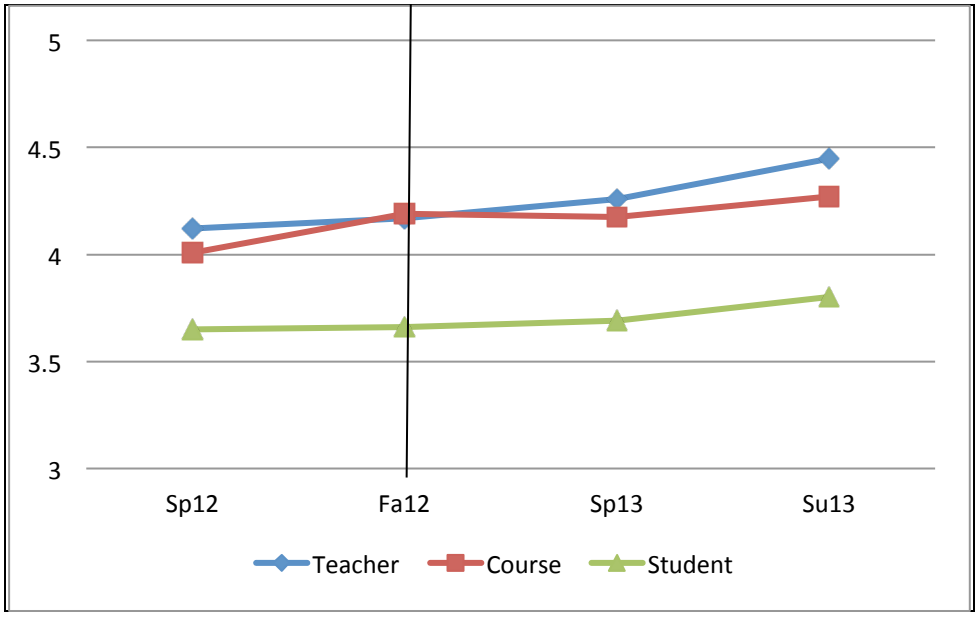

Figure 3. Multi-semester comparison of student satisfaction of teacher, course, and classmates in Public Health.