Check for
updates

A Learning Community Approach for Post-Secondary Large Lecture Courses

Steven P. Ehrlick[1]* and James Slotta[2]

[1] RTA School of Media, Ryerson University, Toronto, ON, Canada, [2] Lynch School of Education, Boston University, Boston, MA, United States

This design-based research (DBR) study examined the ways in which a learning community approach can be enacted in large undergraduate lecture courses through a scaffolded, complex curricular design that utilizes active and inquiry-based learning. By combining a traditional lecture with breakout tutorials, the study involved two iterations, firstly by adopting the Fostering Communities of Learners (FCL) pedagogical model, then by augmenting the model by blending its methodology with elements from a more recent model called Knowledge Community and Inquiry (KCI). Both iterations were evaluated for adherence to, and enactment of, the FCL principles. The second iteration was further evaluated to determine the impact of adding a KCI collective knowledge base. Measures included the enactment of the curricular design, achievement of course learning outcomes, the group inquiry project, tutorial activities, and focus groups for teaching assistants and students. Findings provided evidence of the viability and effectiveness of a learning community approach in large lecture courses at the undergraduate level when combining the learning principles of the FCL model with the student-populated dynamic knowledge base. Students achieved both individual and group success in meeting learning outcomes through individual inquiry and collaborative, active learning, with the knowledge base providing a forum for students to share their research and access ideas for their inquiry.

Keywords: learning community, active learning, collaborative learning, inquiry learning, reciprocal teaching, lectures, knowledge community

INTRODUCTION

Few institutional practices have survived the centuries as intact as the university lecture. "The one teaching the many" is the bedrock upon which most professors rely for the transfer of information, with the goal of inculcating knowledge through repeated oral presentations. This instructivist, didactic method of instruction is viewed as a practical means by which learned scholars can transmit their knowledge to the many with the greatest level of efficiency. However, in recent decades this didactic approach has been assailed as ineffective (Bloom and Shuell, 1981; Bransford et al., 2000).

This study presents an account of two iterations of the design and enactment of a Fostering Communities of Learners (FCL) pedagogical model, first conceived and applied by Brown and Campione (1996), which is itself part of the larger domain of study, called learning communities (Bielaczyc and Collins, 2006). FCL has influenced other learning community theoretical models, but has not seen much advancement theoretically or even applications in research studies over the past two decades. The present study afforded the opportunity to develop the FCL model

for an undergraduate environment, augment it with theoretical elements from the Knowledge Community and Inquiry (KCI) model (Slotta and Najafi, 2013), and apply it to the design of a large lecture university course—a domain where it has not been previously attempted.

Recognition of the need for students to acquire Twenty-first century skills is widespread, but pedagogical practices remain largely entrenched in a behaviorist mode of top-down instruction and quantifiable testing. In contrast (e.g., Brown, 1994) viewed students as "active constructors" of their knowledge within a community of learners. Brown and Campione (1996) developed the FCL model to address her learning science conceptual underpinnings.

However, the adoption of such alternative pedagogical approaches in higher education requires the willingness of professors to innovate, spending significant time on their course designs, which would also entail epistemic challenges to students who are not accustomed to such forms of learning. But if the university experience is to be a vital factor in students' future success, then it is important for students to see their university education as providing them with the academic skills they will use throughout their lives. Active learning is a pedagogical approach well-suited to the development of Twenty-first century skills by engaging students in activities designed to promote collaboration, reflection, and problem solving, with the goal of achieving learning outcomes, developing critical thinking and providing applied course content (Bonwell and Eison, 1991; Prince, 2004; Felder et al., 2009). Informed by a constructivist perspective, active learning almost always includes collaborative or co-operative activities (Prince, 2004) where students participate in hands-on, real-life activities which help them connect their experience in school with later experiences after graduation and reinforce a positive attitude toward the institution where they learned these skills.

Any study that includes an active learning component should attempt as far as possible to make a comprehensive assessment of learning outcomes as opinions may vary and data deemed unreliable without it. This study has been purposeful in its curricular design to not only input active learning components but to create criteria to measure the epistemological impact of those activities.

Interpretive Frameworks

The FCL set of principles is both a set of learning science principles and a pedagogical model designed to help students develop expertise in service to their peers, collaborate, and advance their collective understanding through active learning with a community ethos. The structure of FCL consists of individual and group research on core topics followed by the sharing of research by way of several active learning activities, including cross-talk, jigsaw, and reciprocal teaching. The model culminates with the creation and presentation of a consequential task (Brown and Campione, 1996). The model is designed to work with content that requires deep understanding and this works best with "big ideas," transforming the classroom into a learning community. Students begin to specialize, expanding their own potential (the more adept described by Brown as

"majoring"), as the group proceeds toward consensus. Students who understand the topic become advisors to those who are less adept (Vygotsky, 1978). FCL then, at its simplest, is a three-step process—research, sharing, and a consequential task (Brown and Campione, 1996) (**Figure 1**).

Slotta and his colleagues (Slotta and Peters, 2008; Slotta and Najafi, 2013) created KCI with FCL as a foundation, to guide the design of learning community curricula that scaffolds students and teachers in carefully designed inquiry scripts. A main feature of KCI is the creation of a collective knowledge base that is indexed to the specific learning goals of the curriculum. Students provide content for the knowledge base during individual and small group inquiry, argumentation and discussion. This knowledge base becomes as a persistent resource for all inquiry, as students refine their understanding through scaffolded activities.

KCI is based upon three guiding principles: (1) that students work collectively and collaboratively to build their knowledge base, which is both a product of, and resource for inquiry activities; (2) that inquiry activities are connected to themes emerging from the community's collective interests, and (3) that inquiry activities provide assessable outcomes that are linked to the required learning goals (Slotta and Najafi, 2013).

Another contribution of KCI is its inclusion of metacognitive orientation for students and teachers (an "icebreaker") that explains the learning process inherent in the KCI model. This creates for the students an awareness of, and strategies for the mechanics of learning, the execution of the curricular design and an initial understanding of the dynamics at play in the building of a learning community (Slotta and Najafi, 2010).

With the addition of a collective knowledge base to the FCL framework, the design under study approached that of KCI (differing in the retention of the core FCL structures). FCL and KCI share the goal of making the learning community approach more accessible, permanent, and practicable for instructors.

To date, almost all research and experimentation in inquiry-based learning communities has been situated in K-12 classrooms, with much smaller cohorts of students, and relatively lighter content requirements. And as Scardamalia and Bereiter (2010) point out, knowledge building cultures do not pop up spontaneously. They require the diligence and creativity of the teacher in order to maintain a community where ideas are constantly being generated and approved upon.

This study sought to migrate the FCL model from its study and application in middle school to a university setting, swapping children for young adults and the typical K-12 classroom with a large lecture hall. Brown and Campione's (1996) agenda for their research was to "contribute to a theory of learning that can capture and convey the essential features of the learning environments that we design" (p. 290). This too was the intention of the present study—to capture the essential features of the FCL design, particularly when augmented by the artifacts from other learning community theoretical approaches, especially from KCI. Fostering a learning community was the paramount goal, but the researchers recognized that pragmatism also has high currency. Enactment of this complex curricular design first relied on strict adherence to the learning science principles that infused it, and
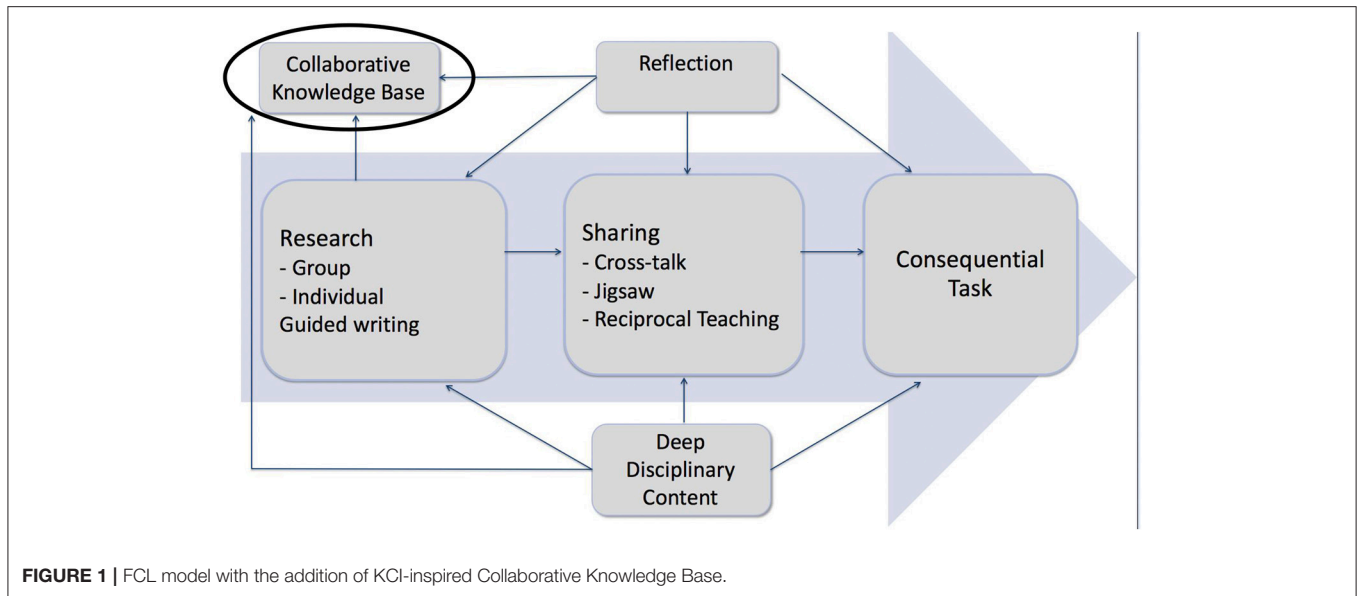
FIGURE 1 | FCL model with the addition of KCI-inspired Collaborative Knowledge Base.

once satisfied, the enactment was analyzed not only for adherence to the design, but whether the model was replicable and useful; a model that is pragmatic was an important ancillary goal.

The purpose of this study is to be the first scientific investigation of the FCL curricular model enacted in a large university course setting, and to investigate the impact of the introduction of a KCI-inspired collaborative knowledge base. This design-based research (DBR) studied the efficacy of a complex pedagogical model in two iterations, situated in a lecture hall setting, populated in each iteration by ∼235 undergraduate students in order to investigate the model's viability and to make recommendations as to improving its affordances for future research and application. Specifically, this study sought to address the following two research questions:

1. How can the FCL model be applied as a learning community approach within a large undergraduate course?
2. What are the limitations of the model, and what adaptations can help respond to those limitations?

METHODOLOGY

Design-Based Research

Applying FCL principles to a university-level course required a methodology that would facilitate the study of multiple iterations of a curricular design and the ability to modify, change, and augment that curriculum. DBR provides certain affordances well-suited for a study of a theoretical curricular design, with successive iterations that follow design, analysis, and re-design cycles (Shavelson et al., 2003), thereby allowing for any modifications and augmentations in the design to reveal themselves in the data. DBR is commonly used in the learning sciences to study "complex educational systems" where theories of learning are given practical application through the construction of an effectively designed learning framework (Bannan-Ritland, 2003). This integrative design is

characterized by iteration of design, enactment and evaluation. This methodology is therefore a logical choice for the design and enactment of a complex curricular design guided by the FCL principles laid out by Brown and Campione (1996) (**Figure 2**).
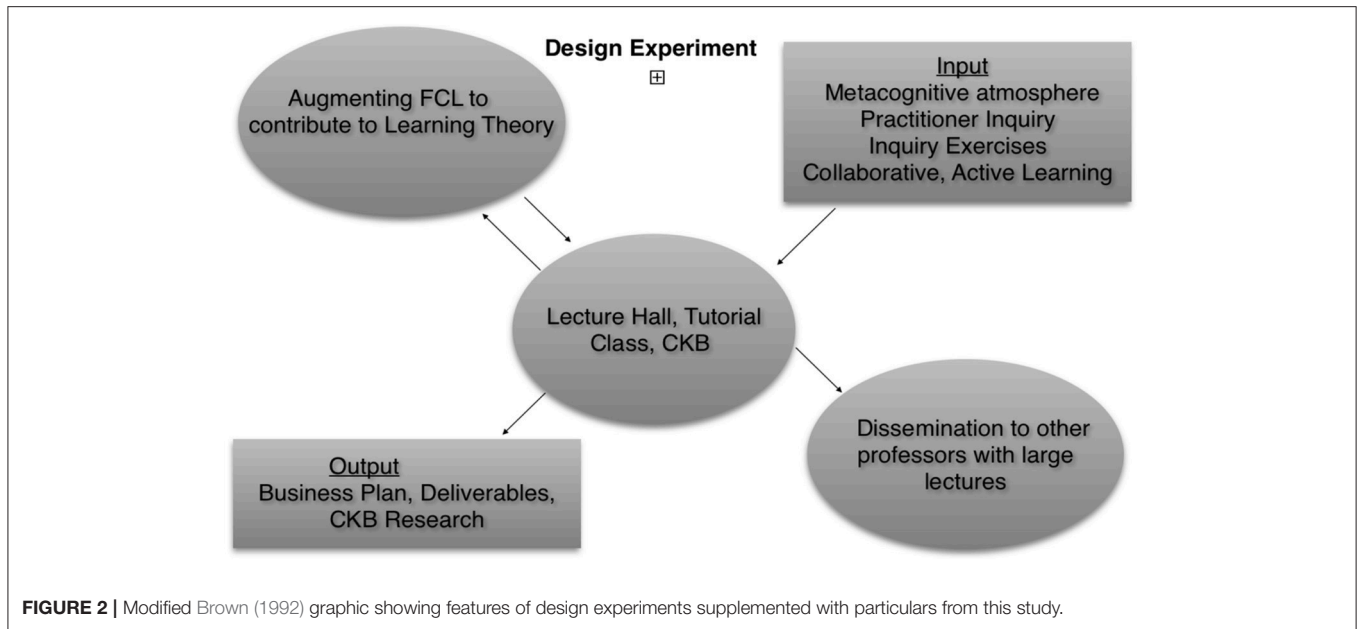
DBR may draw upon a mix of qualitative and quantitative measures. DBR sets out to provide solutions to perceived pedagogical obstacles. Past educational research tended to concentrate on individual differences and the causal effect of interventions. DBR is characterized by a more grounded theory approach, where goals manifest during the running of a course design which spawns more design ideas (Bereiter, 2002). McKenney and Reeves (2013) lament however, that DBR literature tends to focus on design interventions without enough emphasis on new understandings of educational phenomena. Bielaczyc and Collins (2007) identify three tensions in DBR, one between improving practice and refining theory, the second between the individual components and the integrity of the whole design, and finally, the challenges inherent in multidisciplinary research. To be effective then, DBR must attend to both innovative curricular design and a rigorous assessment of tangible results that educators may then be able to implement, mindful of not allowing the improvement of practice to forsake theory development, and vice versa, and with care not to favor particular components at the expense of the overall design.

Participants

This section provides a description of the teaching assistants and students who participated in the study.

Teaching Assistants (TAs)

Four TAs were provided for the course under study. TAs led 11 tutorials and one of the researchers led the 12th. The TAs were fourth year undergraduate students from the same program in which the course was offered, three of whom had previously taken this course.

FIGURE 2 | Modified Brown (1992) graphic showing features of design experiments supplemented with particulars from this study.

Students

The course under study, *Business of Creative Media*, is an introductory general business course designed to introduce undergraduate media students to basic business, legal, and financial aspects of the media industry. The course is a required/elective hybrid. The first iteration included 179 Media Production B.A. program students. The second iteration had 145 Media Production students enrolled in what is for them, a required course. This course was also an elective for the first year Sport Media B.A. program students. There were 54 of these students in the first and 24 in the second iteration of the study. The reasons for the drop off was due to a change in their elective choices. The two iterations also had students from the Creative Industries B.A. program. In the first iteration, there were only two such students. But again, due to changes in electives, there were 46 Creative Industries students in the second iteration. A third program, a New Media B.F.A. program, brought one student to the first and 15 students in the second iteration of the study. In total, there were 236 and 231 students in the two iterations, respectively.

Study Context—Needs Assessment

The first iteration was implemented in the Fall of 2015, followed a year later by the second iteration in the Fall of 2016. The setting was a unique kind of lecture hall: a movie theater, still active in the evenings, rented by the university during daytime hours for large lecture courses. In general, students in media courses are provided intensive labs and lectures in all forms of media production, from television and radio broadcast, to transmedia digital platform story construction.

In the years preceding the study, the course had run as a large lecture, 3 h in duration. There were no breakout tutorials and two TAs were assigned as graders. Workshops were run within the lecture hall, but these were limiting in a number of

ways. Moving students into their groups in an amphitheater was chaotic. There were only 30–40 min of the lecture time devoted to active learning activities and monitoring and proffering advice was limited to those groups closest to the aisles or in the front. Clearly, there was a need for breakout tutorials, and the researcher/practitioner of this study campaigned to have them added, which request was acceded to in time for this study.

The course as of Fall 2015 was structured as a traditional 3-h lecture during odd-numbered weeks while even-numbered weeks consist of a 1-h lecture plus a 2-h tutorial (20 students per tutorial).

Materials

Students have ubiquitous access to the Internet while on campus. The World Wide Web was accessed continually during tutorials and for active learning exercises in lectures (planned and *ad hoc*). Students also had access via the Internet to a learning management program called D2L, utilized by professors for course shells. Access to materials such as lecture slides, course documents, readings and tutorial instructions were housed in the D2L shell.

Methods

Various qualitative methods were used in the collection of data for this study (**Figure 3**). Built into the curricular design were student-generated artifacts that are natural data sources. Others were conceived as additional data sets. This abundance of data has the potential to create confusion, however, methodological choices can be seen to be valid if they provide the researcher with the tools with which to solve a problem (Trow, 1957).

The following forms of data collection were used to collect student experiences: (1) student and TA focus groups; (2) student generated artifacts (tutorial directed writing exercises, a reflective test and a group business plan); and, instructor field notes. By

FIGURE 3 | Flow chart of methodology and data collection.
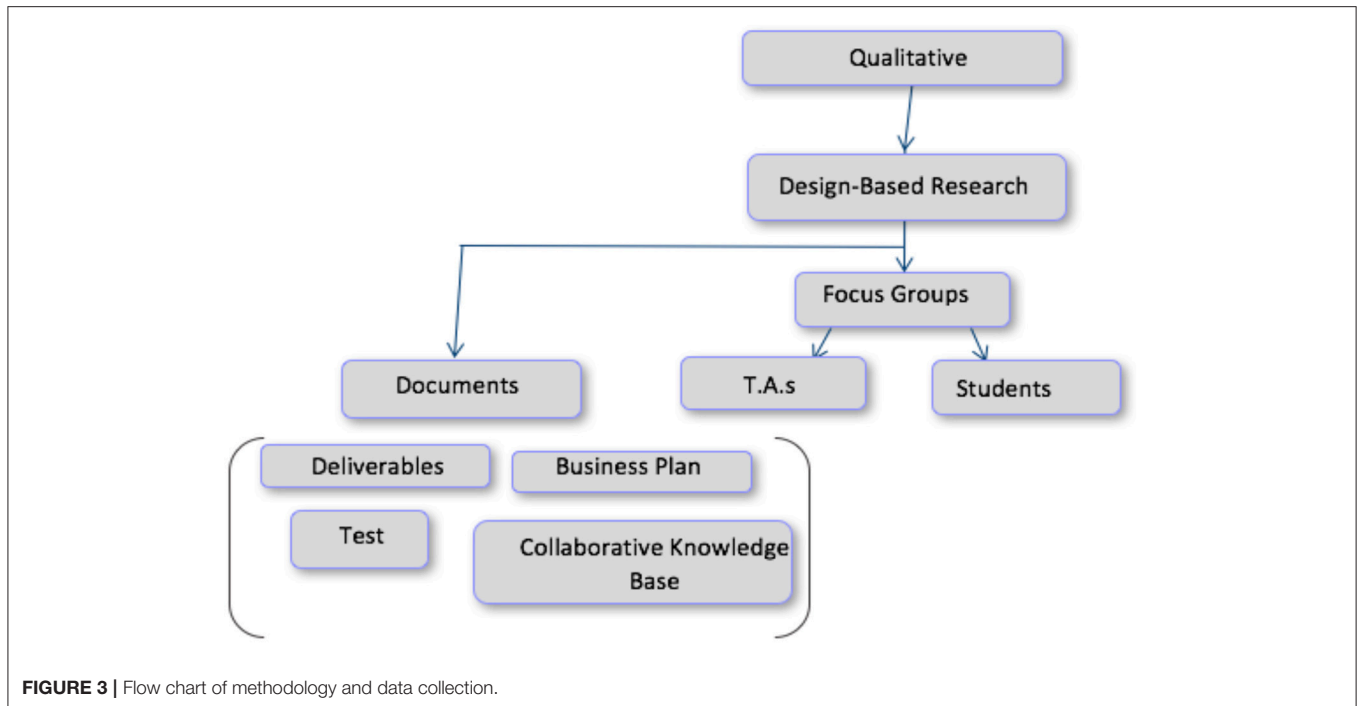
collecting and utilizing different qualitative methods, the plan was to prevent important research phenomena from escaping notice, rather, allowing such phenomena to surface (Erzberger and Kelle, 2003).

The test for the second iteration (which was reflective in nature for both iterations), was uploaded in digital form to D2L. This allowed for content analysis of each student test answer using the software NVivo, as well as for both focus groups (student and TA). Content analysis is a versatile method for analyzing text data (Cavanagh, 1997; Chi, 1997). Grades provided the data for some basic statistical comparisons.

COURSE DESIGN—ITERATION ONE

In this section we address our first research question: How can the FCL model be applied as a learning community approach within a large undergraduate course? The first iteration was designed to study both adherence and enactment of the FCL pedagogical model first developed by Ann Brown and her colleagues. The first iteration was intended as a baseline test of an FCL-designed curriculum enacted in a large lecture course with tutorials. Once satisfied with the adherence to the model, the curriculum was enacted to determine whether the design successfully fostered community amongst students. Specifically, did design elements such as cross-talk and jigsaw enhance student learning; were the lectures effective "benchmark lessons" and did they provide linkage to tutorial activities? The researchers analyzed the model in order to highlight deficiencies and learn how modifications and augmentations might be added to the design to create and sustain a more robust and effective learning community in a university setting with a large number of subjects.

The course was 12 weeks long. On odd numbered weeks a 3 h "benchmark" lecture was delivered. On even weeks a 1 h lecture was delivered then students spent 2 h in a tutorial (a total of six throughout the term). There were 12 tutorial sections, 11 run by the four TAs and one run by the researcher/practitioner. In essence, the 12 tutorials provided the researchers with 12 discreet classes in which to run an FCL curriculum. Two sessions were spent with the TAs instructing them on the framework of constructivism and the principles of FCL. The tutorials were scripted so that as much as possible, TAs served as time keepers and advisors, moving activities along on a schedule scripted by the FCL design. TA Instructor Notes were prepared, offering guidelines and potential issues as well as providing an explanation of the learning outcomes for each tutorial.

The purpose of the tutorials was to effectuate learning into action by having each group "incorporate" a company with the group members as its shareholders, directors and officers. Each tutorial was scripted to firstly reinforce the lecture topics and then to provide hands-on active learning exercises to increase individual and group knowledge funds in order to enable them to draft a comprehensive business plan. Each tutorial workshop culminated with a directed writing task, a short summary of each group's research activities ("Deliverables") sent to their TA for assessment. The tutorials were designed to reinforce the lecture material, provide hands-on individual and collective research and communal sharing of that research through cross-talk and jigsaw. In cross-talk, the TA would designate an officer, for example, the VP Legal, to explain and summarize to the tutorial class what their group had learned after researching a sub-topic. In other tutorials, an emissary from each group was sent into the other three groups to explain a sub-topic which had been researched by

their group; at other times, officers with the same office convened to discuss their group's sub-topics. The idea behind jigsaw is to disseminate subtopics in order for all groups to comprehend the entire topic. These topics must have rich content, able to be sub-divided so that by being exposed to all the sub-topics students can then understand the entire topic. A topic such as the law of copyright is one such example, where the sub-topics of copyright term, copyright ownership, infringement, and what constitutes a copyrighted work would be assigned to different groups for individual and group research prior to dissemination to the entire class by way of cross-talk or jigsaw. In this way the entire class is exposed to the totality of a given topic, gaining access to research applicable to their company. The tutorials were thusly scripted in such a way as to increase each student group's knowledge fund in order to complete the culminating consequential task, the drafting of a business plan for their business.

The tutorials contained scripted components that helped guide the "officers" (CEO, CFO, etc.) of the company to contribute their knowledge fund to the business plan. An emphasis on business innovation was highlighted in lectures and tutorials. These students live in a start-up world and as such, were encouraged to come up with innovative businesses and new ways of conducting their businesses. This coincides, for example, with Scardamalia and Bereiter's (2010) knowledge community principles of applying real ideas to authentic problems, of improving on existing ideas, exploring idea diversity, and building knowledge that has value to others.

Each tutorial ended with a Deliverable, a guided writing exercise that answered a research question, summarized the group's individual and collective research, clarified questions that related to their roles and factors particular to their companies and made predictions on the impact of their research on future issues related to their business plan. Deliverables were emailed to their TA for assessment. Each Deliverable was worth a maximum of 5% of a student's total grade, graded collectively. The scaffolded tutorial design offered a real-life scenario for students. For example, in the first tutorial, groups were instructed to incorporate a company[1]. Each group was required to decide the type of media company they would become and nature of their product or service. Would it be a production company making documentaries or a talent agency? The choice was left to the students, the only criteria being that the company be media-related. This lead to an interesting variable in the scripting of the design as there were instances where companies would be required to find ways to complement each other's companies (e.g., one company providing a service or product to another) and even pitch their companies collectively to a virtual investor. In some tutorial sections the companies complimented each other as if planned; in others the connections were tenuous. But all groups started with the same corporate structure.

The first tutorial established the corporations, as outlined in **Box 1**. The second tutorial reinforced the benchmark lecture on the law of copyright, each officer conducting individual research on a sub-topic followed by a roundtable discussion of what each officer discovered regarding their assigned copyright issue and how it might affect their company. Each group's VP Legal officer then described to the entire tutorial class the nature of their company's business and assessed if any of the other three companies might be ones they could do business with. The third tutorial dealt with finance, again reinforcing a lecture by the professor and a guest media industry CFO. Groups were encouraged to work with a dynamic budget spreadsheet, adding revenue, and costs in preparation of the budget they would produce for their business plans. Four financial documents were then assigned, one to each group (balance sheet, income statement, etc.) followed by a jigsaw activity where the CFO from each company made the rounds to the other three companies explaining the nature and purpose of the document that their group had researched.

During the fourth tutorial, a screenplay sample with Errors & Omissions issues was analyzed by each group. Groups were then asked to discuss the intellectual property issues they may have with their own company model and these were shared across companies. In the fifth tutorial, students took an abridged Meyers Briggs Personality Test. After discovering their personality type, a group discussion ensued, intended to shed light on each company's group dynamic. The companies were then instructed to downsize and reduce salaries. This had the dual intention of bringing to the surface any discord amongst group members and to give students a platform for discussing who was not pulling their weight in the company. There was also a jigsaw activity where officers with the same title could swap companies but no students in any of the tutorial sections took the opportunity to do so.

In the sixth and final tutorial, a surprise presentation was sprung on the groups. Each company had an hour to pull a pitch together for investors. CEOs were instructed that these investors were looking for four companies to invest in, so the four pitches needed to have a common theme and the complimentary aspects of the four companies addressed.

Concurrently, lectures covered "benchmark" topics, including law of copyright, law of contract, corporate structure, leadership, corporate culture, emotional intelligence, legal issues in media and the art of negotiation.

Assessments

The business plan was worth 50% of each student's total grade, with 20% of the scoring rubric devoted to individual assessment. The tutorial workshops Deliverables were worth 5% each. The test was worth 20%.

Enactment of Iteration One

To the extent that adherence to, and enactment of the FCL curricular design was the primary goal of the first iteration, this phase was a success. The previous year's running of the course had led the researchers to believe that introducing FCL elements to the newly added breakout tutorials would provide the environment for achievable enactment of the FCL model.

---

[1]Groups filled in an actual government-issued Articles of Incorporation form, setting out shareholders, first directors, and issuance of shares, but only sent it to their TA.

BOX 1 | Excerpt from Deliverable 1—first tutorial.

Deliverable 1 - Company Creation/Board of Directors and Officers Election. Corporation research.

1. Your GA will put you in your groups of 5. Each group has a number 1 through 4. This number will be used throughout the term.

2. Download articlesform.pdf at: **D2L > Content > Deliverables > Deliverable 1**. This is a fillable pdf file. Fill out sections 1, 2, 3, 4, 6 and 10 in the Articles of Incorporation Form document (name of corporation, address, names and addresses of first directors). For item 6 write in "Five Common Shares". You are issuing one common share to each group member. Come up with a name for your company or create a numbered company like 123456 Ontario Inc.

3. You are all now shareholders and board members with equal equity shares in the company. You each own one Common Share. Your task is to hold your first Shareholders Meeting to formally elect the Board of Directors. The Board will consist of:

DIRECTORS

Chairman of the Board (1)

Directors (4)

The Chairman of the Board chairs director meetings and casts a vote to break a tie. Directors advise as to overall corporate activities and direct its course strategically. Directors do not run the company day-to-day. They appoint Officers to run the company. Often, especially in small private companies, directors are also officers. This will be the case in your company.

Hold your first Shareholders Meeting and elect the Board of Directors. If you wish to be Chairman you may address the Board as to your qualifications (which may just be the desire to be the Chairman!). Appoint one member of the board as the Chairman of the Board. There are no significant extra responsibilities for being Chairman other than being the final arbiter when there is not consensus on a particular issue.

4. Once the Board is elected, the Shareholders Meeting ends and the Board will meet for the first time to elect officers. The Chairman will call a meeting of the Board of Directors.

5. The following offices must be filled and salaries allotted. **The budget for salaries is 50 coins. You do not have to spend all of the coins.**

President and CEO

Secretary and COO (production)

Treasurer and CFO

Vice President Legal

Vice President Marketing and Sales

The Officers are responsible for the day-to-day running of the company. They report to the Board. In this case, you are reporting to yourselves.

You must appoint and fill all of the positions above and assign salaries. This will impact responsibility over different aspects of the business plan. YOU CAN CHANGE THESE POSITIONS AT ANY TIME BY CALLING A BOARD OF DIRECTORS MEETING.

6. End the board meeting. **Create a resolution for the Board meeting**. A template can be found in:

D2L > Content > Deliverables > Deliverable 1.

Make sure to include all of the offices in paragraph 5 above. You will also assign Secretary and Treasurer offices to the COO and CFO respectively.

7. Next, the Officers will meet once they are appointed to discuss what their production mandate will be. Is this a film documentary company? A web design company? An app development company? Create a short list of ideas. Now do some preliminary research on your own (10 min). Go around the group and pitch ideas. Come to a consensus. **Write an elevator pitch on the type of production or service you are forming the company around**. You are not stuck with this business idea. You may well find that you need to pivot later in the term. Keep in mind that your main assignment is a business plan, not a production bible. The production or service will dictate the financial, personnel and infrastructure needs of your business. Make sure you can handle the production from a business point of view. There are only five of you. Imagine you are really going to start this company. How will you execute your vision realistically?
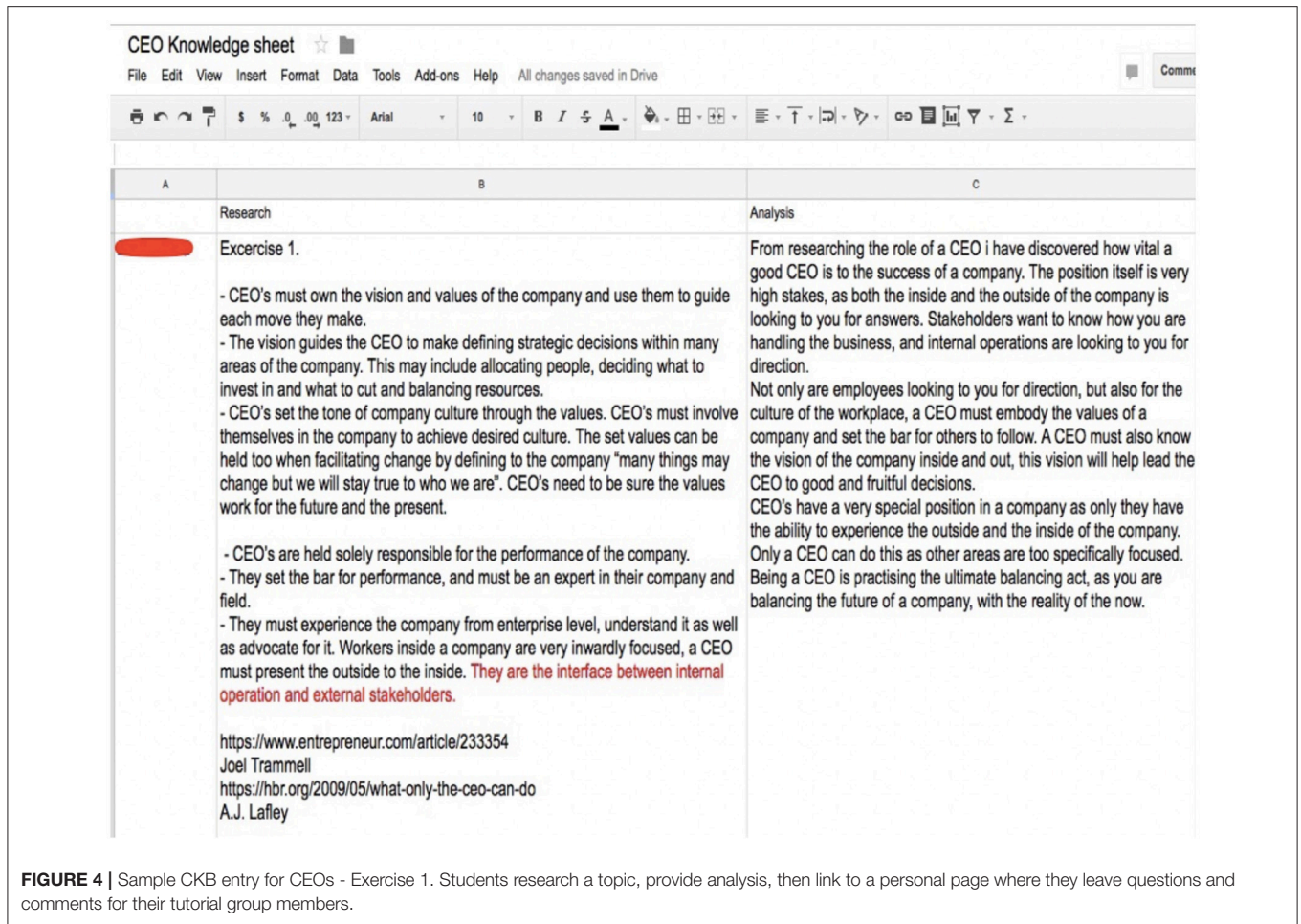

But the lectures remained largely instructivist, and only partially fulfilled the FCL requirement of "benchmark lessons." Some were merely instructional and used to clarify and highlight the previous 3 h lecture. To whatever extent the lectures could be considered benchmark lessons, they still did little to reinforce the learning community ethos within the class as a whole.

In essence, the first iteration design created 12 distinct communities of learners - without any student perception of belonging to a community of learners outside of their tutorials and small groups. Students within their tutorial sections were unaware of the research being conducted in other tutorial sections. There was no opportunity, no means for students to interact with other student's research activities by way of active learning activities outside of their own tutorial class. It became clear that a more global (i.e., whole class level) repository for research activities could help promote better awareness and exchange across the tutorial sections.

SECOND ITERATION

In this section the researchers addressed the second research question: What are the limitations of the model, and what adaptations can help respond to those limitations? The second iteration of the curriculum design involved the introduction of a Collaborative Knowledge Base (CKB) and the student research activities that populated it (see **Figure 4** for an example). Thus, a digital repository for individual student inquiry and "knowledge" was conceived, to provide a means by which students could share work, learn from each other, and create a sense that the entire class was working together as a learning community. The CKB was added to the curricular design in order to connect off-campus research activity, active learning in lectures, and group activity in the tutorials. Hence, the first iteration laid the groundwork for the second, in part by exposing the limitations in the curriculum.

As in the first iteration, the analysis focused on (1) adherence of the design to the pedagogical model, and (2) faithful enactment

FIGURE 4 | Sample CKB entry for CEOs - Exercise 1. Students research a topic, provide analysis, then link to a personal page where they leave questions and comments for their tutorial group members.

TABLE 1 | NVivo Main and Child Codes used to analyze test question and focus groups.

Main codes	Child codes		
CKB Use	CKB as future reference	Referring to research of others	CKB and lecture linkage
Community of Learners	Collaborative learning	CKB and lecture linkage	Referring to research of others
Inquiry Learning	Research above and beyond	Compelled (pushed, forced) to do research	Gained expertise
Future Application	Real life experiences	CKB as future reference	Gained expertise

of the design during the course itself (i.e., the instructor did what was designed), as well as (3) student learning outcomes. Student assessment would remain virtually unchanged except for 10% of their grade which was allotted to the research exercises that populated the CKB. Unlike the first iteration of this study, particular attention was paid to the test, which was written on digital devices and uploaded to D2L for marking. One question was formulated to require students to reflect on their use of the CKB. Coding of this question was developed to identify the following major themes: CKB use, community of learners, inquiry learning, and future application. **Table 1** outlines the codes used to analyze the test and the student and TA focus group transcripts.

Analysis of focus groups included the adoption of a micro-interlocutor analysis based upon the work of Onwuegbuzie et al.

(2009), whereby the focus group is assessed both as a group and as a series of individuals, which enables the researcher to record the responses of members who may not be contributors of a particular theme, but whom are nonetheless recorded and acknowledged in the overall analysis. For instance, such analysis might reveal a student who is silent, contrary or who tends to go along with the majority view. Eight randomly selected students partook in the focus group. All officer positions were represented.

Design Changes—Curriculum
Collaborative Knowledge Base (CKB)

The decision to add a Collaborative Knowledge Base to the curriculum was influenced by two theoretical models. Early on in their research, Scardamalia and Bereiter (2010) were

interested in examining whether students reading other student's work would improve their ideas. Slotta and Najafi (2013) point out that Web 2.0 technologies have provided new tools for innovative pedagogical approaches. The researchers were faced with two significant issues before turning theory into practice: (1) what technology to use and (2) how to design it to allow a learning community to manifest? It was decided to experiment with a Google Doc spreadsheet. The following criteria were needed for a CKB to succeed as a user-friendly, collaborative research repository: ease of use, coherent structure, and usefulness. As each tutorial was composed of four groups containing five corporate officers, a research page for each officer was created. This meant 48 students assigned to each page—a more manageable number technically as well as from a student interaction point of view. Students were given research exercises catered to their particular office. The CKB exercises were assigned on a Thursday and were due to be uploaded by the following Monday's lecture.

During the lecture, the Google Doc was brought onscreen and students were called upon to explain their research and analysis. If, for example, a CFO student was selected for commentary, other CFOs were asked to join the discussion. The instructor would then switch to another student with a different role in his or her company, and the discussion would begin anew. In this manner, individual research was brought into the large lecture. During tutorials, groups were instructed to go back into the CKB and, using reciprocal teaching, explain to the other officers their research and its impact on the company.

This discussion of CKB research occurred during the beginning of five of the six tutorials (the sixth was the presentation day). Students gained knowledge related to their roles, then brought that knowledge back to their group for dissemination. In other words, they participated in a "conference" with their fellow officers, allowing them to instruct each other and better understand each officer's role. This would hopefully improve their business and be reflected in their business plan. As one student put it, "There were many times our group referred to a CKB exercise (not just the previous weeks, but all CKB exercises) to help build proper financial decks, or create a proper business plan."

By creating a permanent repository for individual research, students were able to share their findings and analysis both with the wider audience of the entire class as well as in their tutorial groups, thus strengthening the distributed expertise of each individual who had the opportunity to share that expertise with peers, sometimes in the large lecture, but always with their fellow officers. The CKB thus served as a permanent collection of research by individuals, which benefited all groups in all tutorials as a resource that aided them in the formation of their business plans. Student participation in the CKB added a research element missing from the first iteration and provided students with an opportunity to conduct deep inquiry related to their particular office. The curriculum became more ambitious with the addition of the CKB; it provided a valuable addition to the overall design. The CKB reinforced, in the minds of the student subjects, research, helping, understanding, learning, and knowledge, among other concepts.

Enactment of Iteration Two

The CKB was analyzed for evidence of its effectiveness as a medium for individual inquiry and as a viable research repository where students would populate the CKB with their own research and possibly benefit from the research of others. It was analyzed to see if there was any discernable increase in the achievement of learning outcomes across the student population.

Grades were first analyzed to detect any statistical differences in the performance of students from both iterations. The test conducted during the first iteration produced a median score of 81.7%. The median test score for the second iteration was 82.4%. The difference between the two medians is negligible (SD of 0.35), however, students in second iteration produced a 9.4% increase in the number of scores over 90% with a standard deviation of 10.5. Notable as well, is that while the frequency of students with the highest marks (A+) was significantly higher in the second iteration, overall, students in the first iteration fared better in the test (**Figure 5**). This may be as a result of the increased individual workload for students in the second iteration phase of the study which provided the opportunity for fatigue or apathy.

Grades for the business plan show the most significant disparity between the two iterations. The student frequency for the grade range of A− to A+ (between 80 and 100%) was 51.2% for the first and 61.5% for the second iteration (SD of 5.15). The grading rubric for the two iterations was identical which was designed to mitigate discrepancies in marking by the TAs during both iterations. In the first iteration it was necessary to have one of the TAs more normally distribute her grades as they initially fell significantly lower than the assessments of the researcher and the other TAs. This adjustment was unnecessary in the second iteration.

An examination of the content of student focus group transcripts and the answers to Question 2 of the test revealed several themes, including the impact of the research contributions of others. With regards to the test, 50% percent of the student population who wrote the test digitally ($N = 223$) made favorable comments concerning the benefit they gained from reading the research of other officers from other companies in the CKB, many of the students offering more than one example. As one student noted:

> "Everyone in this class had a different view on each exercise and everyone's company is different. Reading through all their answers gave me so many different perspectives and helped me to grasp some concepts more easily when put into different words. For example, while I had only listed three aspects of being a CEO which I had deemed most important, others had listed different aspects that I realized were also important points and which gave me a much better understanding of my position."
>
> -Student test response

The ability of the CKB to help students understand the parameters of their role by reading the work of fellow officers was a constant theme in answers to Question 2. The CKB provided some students with a leg up when they experienced frustration or anxiety due to being thrust into corporate positions they knew little about. As another student comments in the test:
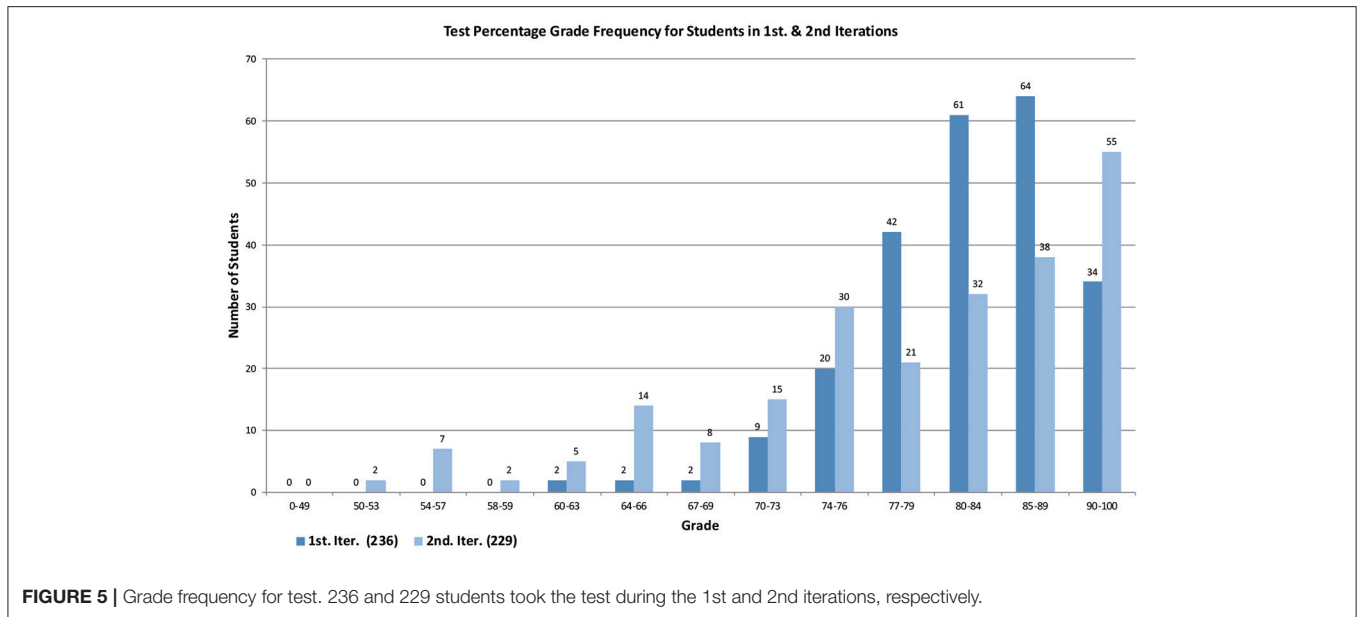
FIGURE 5 | Grade frequency for test. 236 and 229 students took the test during the 1st and 2nd iterations, respectively.

"Another CKB exercise I remember specifically is #3, which required the examination of different types of business models. I remember being unsure which business model would work best for the company we were designing, so I looked at other COO's businesses that were similar to ours, and the models they decided to use. This helped me vastly in deciding what would be best for our company, and the CKB exercises in general deepened my overall understanding of the entire class."

-Student test response

Thus, a recurring theme found in student answers to Question 2 related to them reviewing other student's work in order to better understand their own roles and the tasks which lay before them when it came time to draft their company's business plan. Another theme that arose from analysis of the focus group transcript was the notion that the CKB removed the perceived glamor of such positions and replaced idealized perceptions with realistic expectations and foundational knowledge of the actual job description.

In the student focus group ($N = 8$), participants were asked a similar question, regarding the extent to which the CKB had augmented their understanding of their roles with regard to the business plan. This question evoked strong positive responses, with focus group members stating without any exception that reading the work of others had enhanced their understanding of their roles and reinforced that they were on the right track with their own research. They also noted that reading articles other students had posted enhanced their understanding of their role, that different perspectives added to their own, and that conducting research with real- life examples had enabled connections between theory and more practical applications.

Inquiry-based learning is a bedrock principle in the learning community approach, whether FCL or KCI. The first iteration provided instances of individual inquiry but this was greatly expanded with the addition of the CKB research exercises. The

hope was that university students would recognize the benefit of researching deeply into topics, gaining valuable opportunities to critically in the general sense, and more specifically, to hone professionally relevant Twenty-first century skills. After coding Question 2 of the test, certain words appeared and re-appeared that were associated students' research exercises for the CKB. These words were *pushed, forced* and *helped*. Twenty (20%) percent of respondents ($N = 233$) made reference to how the CKB research exercises forced/pushed/helped them do research they otherwise would not have participated in. There were 36 individual student mentions of being "forced" to go beyond their academic comfort level.

Another recurring theme was acknowledgement that the parts helped create the whole, that individual research when shared with the group, created a collaborative environment where information was shared, aiding in the completion of the business plan. Students became aware of their own learning, describing the metacognitive nature of the curriculum. In the student focus group, a participant made this statement, with which all others in the group readily agreed:

I just thought that the tutorials served as like a perfect bridge between the CKB and the business plan, because you researched what you had to work on for your CKB and then you would have to translate that into your collaboration with your group members within your own role, in a very explicit way, which we would end up using for your business plan. So - the CKB was a perfect bridge that tied the two elements of the course together.

-Student in a Focus Group

As to be expected with 48 groups, not all groups achieved the same high level of collaboration. Some groups exhibited the all-too-familiar characteristic where some members were dedicated, conscientious and willing to carry more of the load than other members. Some groups thus fell short of achieving the goal

of collective cognitive responsibility. One student talked about hoping each week that her group members would begin to work collaboratively, but was disappointed each time. Another described the common situation where two or three members picked up the slack, students who saw the value in the course and were high achievers. The researcher/practioner estimates that approximately one group in five were underperforming in this fashion.

DISCUSSION

The above sections describe an unprecedented opportunity to enact a complex learning community curricular design in a large undergraduate class and to run two iterations of the course to allow for re-design and reenactment of the model. Despite the impossibility of having the same cohort as subjects for both iterations, the specialized nature of the undergraduate programs from which students were enrolled ensured a certain amount of student coherence between iterations.

In response to the first research question (How can the FCL model be applied as a learning community approach within a large undergraduate course?), the goal of the first iteration was to successfully design and enact an FCL modeled curriculum, modified to enable the curriculum to be delivered at a university level course with a large body of students. The design was guided by five assumptions, namely, that (i) the middle-school design of previous studies would have to be modified to facilitate the learning capabilities and expectations of university students, (ii) the activities, particularly the consequential task, would need to be grounded in real-life activities in order to be perceived as relevant and maintain student interest throughout the term, (iii) the consequential task should be directly connected to the learning domain in order to provide a basis for analyzing the effectiveness of the learning undertaken by students, (iv) consideration would have to be given to the limitations imposed by the physical context of a large movie theater converted into a lecture hall room, and, (v) the model would have to be adapted to run in 12 different tutorial sections with the researcher present in only one, relying on TAs to lead students through FCL-devised scripting.

This course covers a spectrum of business concepts as previously enumerated. The design thus had to be flexible enough to incorporate these topics and still remain true to the FCL model. This was accomplished by making all topics tethered to the consequential task (i.e., the business plan), a culminating inquiry project that was indexed to the full space of content. The topics were the tributaries and the business plan was the river. By the time students reached the mouth, to carry the metaphor forward, the river of knowledge was at its deepest and widest.

In response to our second research question, (What are the limitations of the model, and what adaptations can help respond to those limitations?), the addition of the Collaborative Knowledge Base provided the linkage between individual inquiry, lectures, and the collaborative work being conducted in tutorials. Instead of 12 discreet learning community pockets, the CKB provided an umbrella of shared individual research that at times the entire population viewed in lectures, and in others where such research was shared amongst group members and the other groups in the respective tutorials.

The introduction of the CKB into the curriculum involved a major overhaul of the curricular design, allowing for more individual inquiry, more sharing of research in lectures and providing a permanent repository of student research that all students and groups had access to. With the introduction of the CKB, lectures shed much of their previous instructivist flavor by replacing instruction and guest time with the display of CKB research onscreen, providing the opportunity for class-wide discussion and analysis on a myriad of topics. This promoted a learning community ethos in the lectures, an element missing in the first iteration.

Student participation in the CKB added a research element missing from the first iteration and provided students with an opportunity to conduct deep inquiry related to their particular office. This had a cumulative effect as research traveled from the CKB to lecture to the tutorials where groups reviewed each other's work, conducted reciprocal teaching, and developed skills necessary to collectively build a business plan.

The researchers made other significant findings related to active learning at this academic level and with young adults as subjects. They observed that the more the course subject matter and activities resemble real-life experiences, the more likely university students will perceive the course, the activities, and the professor as being credible. And if a learning community model adopts an approach of presenting students with real-life questions and provides exercises that produce tangible, authentic artifacts by way of active learning (i.e., if students detect a direct link from the learning community activity and getting a job), the course will more likely be accepted as having intrinsic value. Students must see concurrent value in their research and the artifacts they create or these activities will be relegated to an exercise that must be completed for a grade and nothing more. This real-life aspect of the curriculum should be further infused into future iterations.

The fundamental ambition of developing this augmented FCL model was—revisiting the acronym—to "foster a community of learners" in a large undergraduate lecture class. Students, by way of individual inquiry and collaborative knowledge building, worked together to create a real-life artifact, the business plan. Students also demonstrated their acquired knowledge in a curriculum that spanned a wide range of topics. Learning outcomes were achieved and overall the course was well-received. But how well was a learning community really established, beyond the tutorial sections, and what impact did this have on learning? The addition of the CKB and the ensuing discussions generated by the students' research within the lectures is a good start. But despite some evidence that a sense of community was established class-wide, it is impossible to state what effect this may have had on learning. Thus, it is important to reserve any claims about the effect of a learning community approach on actual learning by these subjects—if only to spur future research in this area and guide

future iterations that aim to further reinforce this sense of community.

Finally, this study greatly benefited from having one of the researchers in the classroom, which allowed for a first-hand, unmediated experience regarding the execution of the design in both iterations. We therefore conclude with these final observations from one of the authors.

A professor conducting practitioner inquiry has a different role than in a co-design with a teacher. There is less contact with the students (once a week) and given the number of students in a large lecture, less ability to script one's role. Lectures are fluid and dynamic, therefore the researcher must balance his or her lecture between engagement and instruction, allowing for unintended or unscripted variances to occur.

Secondly, it is vitally important that the instructor thoroughly communicate to students the metacognitive aspects of learning communities and their responsibilities within it in order to achieve "buy-in" from the students. This can be achieved by informing student not only of how the course will run, but how this approach will provide students with critical thinking skills, collaborative learning, and learning community.

Thirdly, the instructor of a large lecture with breakout tutorials must accept that delegation is part of the design. It is therefore vitally important to select TAs who understand the intent of the design, can enact it as the instructor's proxy in their tutorial sections, and can observe the enactment critically so as to provide relevant input during the TA focus group. This is a different scenario than that of the researcher who creates a co-design with a teacher then stands back to let the enactment occur. The temptation of the practitioner-researcher who does not have complete supervision of the enactment is to hover over the TAs, visit their tutorials, and affect the scripting merely by their presence. This impulse must be resisted and satisfied by trust in the design. In other words, the instructor must be mindful of the Hawthorne effect.

Finally, it is important to leave the "researcher" outside of the classroom. In the role of instructor, it is important to be guided solely by the lesson plan, by the curricular design, and not allow one's researcher mind to influence what is happening in the classroom.

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of the Research Ethics Boards of the University of Toronto and Ryerson University with written informed consent from all subjects. All subjects gave written informed consent in accordance with the Declaration of Helsinki.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

REFERENCES

Bannan-Ritland, B. (2003). The role of design in research: the integrative learning design framework. *Educ. Res.* 32, 21–24. doi: 10.3102/0013189X032001021

Bereiter, C. (2002). Design research for sustained innovation. *Cognit. Stud. Bull. Jap. Cognit. Sci. Soc.* 3, 321–327. doi: 10.11225/jcss.9.321

Bielaczyc, K., and Collins, A. (2006). "Fostering knowledge-creating communities," in *Collaborative Learning, Reasoning, and Technology,* eds A. M. O'Donnell, C. E. Hmelo-Silver, and G. Erkens (Mahwah, NJ: Erlbaum), 37–60.

Bielaczyc, K., and Collins, A. (2007). "Design research: foundational perspectives, critical tensions, and arenas for action," in *Children's Learning in Laboratory and Classroom Contexts: Essays in Honor of Ann Brown,* eds J. Campione, K. Metz, and A. S. Palincsar (New York, NY: Routledge), 89–111.

Bloom, K. C., and Shuell, T. J. (1981). Effects of massed and distributed practice on the learning and retention of second-language vocabulary. *J. Educ. Res.* 74, 245–248. doi: 10.1080/00220671.1981.10885317

Bonwell, C., and Eison, J. (1991). *Active Learning: Creating Excitement in the Classroom.* ASHE-ERIC Higher Education Report No. 1, Washington, DC: Jossey-Bass.

Bransford, J. D., Brown, A. L., and Cocking, R. R. (2000). *How People Learn: Brain, Mind, Experience, and School.* Washington, DC: National Academy Press.

Brown, A. L. (1992). Design experiments: theoretical and methodological challenges in creating complex interventions in classroom settings. *J. Learn. Sci.* 2, 141–178. doi: 10.1207/s15327809jls0202_2

Brown, A. L. (1994). The advancement of learning. *Educ. Res.* 23, 4–12. doi: 10.3102/0013189X023008004

Brown, A. L., and Campione, J. C. (1996). "Psychological theory and the design of innovative learning environments: on procedures, principles, and systems," in *Innovations in Learning: New Environments for Education,* eds L. Schauble, and R. Glaser (Mahway, NJ: Erlbaum), 289–325.

Cavanagh, S. (1997). Content analysis: concepts, methods and applications. *Nurse Res.* 4, 5–16. doi: 10.7748/nr1997.04.4.3.5.c5869

Chi, M. T. H. (1997). Quantifying qualitative analyses of verbal data: a practical guide. *J. Learn. Sci.* 6, 271–315. doi: 10.1207/s15327809jls0603_1

Erzberger, C., and Kelle, U. (2003). "Making inferences in mixed methods: the rules of integration," in *Handbook of Mixed Methods in Social & Behavioral Research,* eds A. Tashakkori, and C. Teddlie (Thousand Oaks, CA: Sage), 457–488.

Felder, R. M., Celanese, H., and Brent, R. (2009). Active learning: an introduction. *ASQ High. Educ. Brief* 2, 1–5.

McKenney, S., and Reeves, T. C. (2013). Systematic review of design-based research progress: is a little knowledge a dangerous thing? *Educ. Res.* 42, 97–100. doi: 10.3102/0013189X12463781

Onwuegbuzie, A. J., Dickinson, W. B., Leech, N. L., and Zoran, A. G. (2009). A qualitative framework for collecting and analyzing data in focus group research. *Int. J. Qual. Methods* 8, 1–21. doi: 10.1177/160940690900800301

Prince, M. (2004). Does active learning work? A review of the research. *J. Eng. Educ.* 93, 223–232. doi: 10.1002/j.2168-9830.2004.tb00809.x

Scardamalia, M., and Bereiter, C. (2010). A brief history of knowledge building. *Can. J. Learn. Techn.* 36, 1–16. doi: 10.21432/T2859M

Shavelson, R. J., Philips, D. C., Towne, L., and Feuer, M. J. (2003). On the science of education design studies. *Educ. Res.* 32, 25–28. doi: 10.3102/0013189X032001025

Slotta, J. D., and Najafi, H. (2010). "Knowledge communities in the classroom," in *International Encyclopedia of Education Vol. 8,* eds P. Peterson, E. Baker, and B. McGaw (Oxford: Elsevier), 189–196.

Slotta, J. D., and Najafi, H. (2013). "Supporting collaborative knowledge construction with Web 2.0 technologies," in *Emerging Technologies for the Classroom,* (New York, NY: Springer), 93–112.

Slotta, J. D., and Peters, V. L. (2008). "A blended model for knowledge communities: embedding scaffolded inquiry. International perspectives in the learning sciences: crea8ing a learning world,"in *Proceedings of the Eighth International Conference for the Learning Sciences - ICLS 2008* (Utrecht: International Society of the Learning Sciences, Inc), 343–350.

Trow, M. (1957). Comment on participant observation and interviewing: a comparison. *Hum. Organ.* 16, 33–35. doi: 10.17730/humo.16.3.cx277m417x00w647

Vygotsky, L. S. (1978). *Mind in society: The Development of Higher Psychological Processes.* eds and Transl. by M. Cole, V. John-Steiner, S. Scribner, and E. Souberman (Cambridge, MA: Harvard University Press).

Conflict of Interest Statement: The handling editor is currently co-organizing a Research Topic with one of the authors, JS, and confirms the absence of any other collaboration.

The remaining author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.