An Exploration of Transfer of Learning Opportunities in an Online Co-operative Education Preparatory Curriculum

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Abstract

This study investigated the opportunities for the transfer of learning in a university-level online co-operative education (co-op) preparatory curriculum that is designed to support co-op students' transitions between the classroom and the workplace. An analysis of students' online discussions was undertaken for the primary purpose of determining if the thinking skills exhibited were consistent with what is understood about bridging techniques that support the transfer of learning. A thematic analysis based on a priori codes was used. Key findings with respect to demonstrating support for the transfer of learning are: 1) strong evidence for metacognitive reflection, 2) some evidence for anticipating applications and parallel problem solving, 3) limited evidence for generalizing concepts, and 4) weak evidence for using analogies. The findings have implications for those who design and teach in co-op programs and for further research.

Keywords: Bridging techniques, thinking skills, transfer of learning, co-op.

This study investigated the opportunities for the transfer of learning in a university-level online co-operative education (co-op) preparatory curriculum that is designed to support co-op students' transitions between the classroom and the workplace. Specifically, students' online discussions were analyzed to determine if the thinking skills exhibited were consistent with what is understood to support the transfer of learning.

Context

Co-operative Education programs are the prototypical educational models that are meant to bridge academic learning with workplace learning and to provide structure (administrative and pedagogical) for that learning experience. Co-op programs provide students with the opportunity to realize that academic and workplace skills, knowledge, strategies and abilities are transferable between the two contexts. As such, co-op has the potential to serve as a vehicle that fosters the transfer of learning.

The first author currently works with a university-level online co-op preparatory curriculum which aims to foster the transfer of learning. The curriculum is an outcome of Johnston's (2003) findings that identified co-op students as more successful in securing work and being successful after graduation than non-co-op students if "self-direction, skills acquisition, and transfer" (p. 8) were explicitly practiced. Johnston's (2003) conclusions align with those of Ricks, Cutt, Branton, Loken, and Van Gyn (1993), Schaafsma (1996), and Van Gyn (1996) who all argued that the work experience in itself is insufficient to ensure transfer of learning. The goals of the online preparatory curriculum are multi-fold and aimed at helping "students better interrelate their school and workplace experiences by emphasizing the process of learning and practice that occur in both and by helping students take more control of their learning and work" (Brown, 1998, p. 6). Additionally, since students rarely make the connections between the social context of school and the workplace (Brown, 1998; Johnston, 2007), the online preparatory curriculum understands transfer as complex and difficult, particularly "because so many features of the two contexts are different" (Brown, 1998, p. 7).

The goals of the online preparatory program are achieved through four learning modules, each with related reflection exercises that students are required to respond to via the online discussion forums. Online discussions occur among peers, the course facilitator, and a co-op employer expert (a working professional from industry). The reflection exercises intend to engage students in social interactions and critical thinking as they share personal experiences and reflect on the chosen topics; importantly students are asked to comment on and build on the ideas of their peers. Table 1 shares a sample of two reflection exercises drawn from the curriculum. The discussions leave room for emergent dialogue and exploration of other topics should students choose to venture in new directions, pose thoughts, or question one another. The intent is to get students to participate actively and collectively as they improve their ideas and share experiences around pre-employment preparation, skills transfer, and personal and professional career development. In this way, the curriculum explicitly teaches the thinking skills required for the conceptual transfer of learning.

Table 1. *Sample Reflection Exercises*

Topic: Metacognition Provide an example of a time you reflected about something you did. Describe the situation and what questions you asked yourself about it. What did you learn and how could you use that to your advantage in future situations? Did you generate any generalizable strategies from the situation? *Tip: While reviewing the postings of your peers, develop a personal list of tools/strategies that you may use to promote metacognition.*
Topic: Enhancing Skills Transfer Name two things you would do to help transfer your skills. Think about how you would use this to prepare for an interview for a position that is different from anything you have done before. Hint: Using a metaphor will assist your ability to transfer your learning by seeing the shared generalizable principles between two situations. *Tip: Once you have read the postings in the discussions that exemplify various generalities, you will notice how two systems often look more similar than they did at first.*

Transfer of Learning

The transfer of learning is fundamental to co-operative education in particular and professional development more generally. It has been assumed that thinking skills necessary for the transfer of learning are acquired as part of formal schooling. Yet Pea (1987) argued that the importance is in synthesizing the "abstract treatment of reasoning considered as the support for transfer of learning, otherwise, students may not notice occasions for school-type reasoning outside the school setting" (p. 52). Bransford, Brown, and Cocking (1999) and Lave (1996) also advocated for abstract representations of knowledge in order to promote transfer of learning, as knowledge that is overly contextualized may impair transfer. Studies that support the positive outcomes of abstract instruction are prevalent. Beiderman and Shiffrar (1987) demonstrated that transfer improved considerably if the instruction involved teaching about the abstract principles inherent in a learning situation. In a study by Singley and Anderson (1989), students showed positive transfer of learning with new text editors if the common abstract structures were identified even if the surface structures were largely different. Further studies by the National Research Council (1994) showed benefits for transfer of learning when learners were asked to represent their experiences and learning at abstract levels that transcend the specificity of the context of acquisition. Holyoak (1984) and Novick and Holyoak (1991) demonstrated that abstract representations become integrated into the learner's schema (the learner's guide to thinking) and do not remain in isolated activities. Finally, Gick and Holyoak (1980) showed that in order to foster flexible transfer, learners were instructed in abstract and general principles and this engaged the learner in the *what-if* problem solving, designed to increase the flexibility of understanding.

Marini and Genereux (1995) stated that the transfer of learning research findings in education and training are "replete with reports of failure" (p. 1) suggesting that significant transfer is difficult to achieve. Educators now understand that transfer may not even occur in situations where it would be readily expected. Consequently, it has been argued that in order to enhance the transfer of learning, educators need to explicitly teach for transfer (Bereiter & Scardamalia, 1986; Palincsar & Brown, 1984; Schoenfeld, 1985). Costa and Garmston (2002) also discussed the need for explicit instruction of thinking skills by way of direct and systematic instruction because learners often do not learn *how to think or think critically* merely by being asked to do so. A key outcome from the transfer of learning findings demonstrates that learners' ability to think critically does not automatically result from study in academic disciplines or subjects. As such, understanding the instructional strategies that are capable of supporting transfer is critical to achieving this goal.

Pea (1987) suggested specific instructional strategies that support thinking skills for the transfer of learning based on his synthesis of the relevant research. The instructional strategies included "learning about and practicing knowledge application in multiple contexts of use, constructively participating in bridging instruction across school and non-school problem situations, thinking and self-management skills taught within domains, and synergistic integration of the learning of different subjects" (p. 38).

It has been suggested that instructional strategies related to teaching thinking skills for the transfer of learning are of two formats, namely *hugging* and *bridging* techniques, both originally discussed by Salomon and Perkins (1988). Hugging techniques foster the transfer of learning by "making the learning experience more like the ultimate application" (Fogarty, Perkins, and Barrell, 1992, p. xii). Fogarty et al. (1992) identified five hugging techniques: **1)** setting expectations, **2)** matching experiences, **3)** simulating situations, **4)** modelling application contexts, and **5)** employing problem-based learning. Bridging techniques foster the transfer of learning by making explicit for learners the conceptual connections between what has been learned and a novel application by "mindfully abstracting knowledge and skills from one context and applying them in another" (Fogarty et al., 1992, p. 64). The techniques are complex instructional strategies that involve, "teaching a general principle and then helping students see how it works in multiple situations" (Pea, 1987, p. 51). Feuerstein, Rand, Hoffman, and Miller (1980) used bridging problems to 1) help students draw on their own experiences, 2) increase the potentially infinite number of applications of principles to authentic experiences, 3) generate examples that index the student's level of understanding, and 4) give students the opportunity to apply the principles in diverse contexts. Lave (1996) stated that bridging instruction was a wisdom that prepared the learner for life and learning in context-free terms. These techniques foster the type of thinking skills that support the transfer of learning required in any co-op preparatory curriculum. Table 2 provides the five bridging techniques as defined by Fogarty et al. (1992).

Table 2. *Bridging Techniques Defined*

Anticipating Applications Anticipating applications is defined as thinking about upcoming opportunities to use new ideas in a different context. Furthermore, it involves thinking about adjustments that will make the application relevant, otherwise referred to as scouting for relevant uses. In anticipating applications, diverse applications are targeted rather than assuming spontaneous transfer will occur. Some examples include asking students to predict possible applications remote from the learning context. For example, after students have practiced a thinking skill, the instructions may ask: Where might you use this or adapt it? Let's brainstorm, be creative and list the ideas and discuss them.
Generalizing Concepts Generalizing concepts is defined as asking students to extract the generic ideas out of a situation and encourage the use of generalizable concepts through looking for principles, big picture ideas, or underlying constructs. Some ways of doing this is to ask students to generalize from their experience to produce widely applicable principles, rules, and ideas. An example from Fogarty et al. (1992) asks after studying the discovery of radium, ask, "What big generalizations about scientific discovery does the discovery of radium suggest? Can you support your generalizations by other evidence you know of?"
Using Analogies Using analogies is defined as finding, creating or analyzing analogies as well as comparing and finding similarities between situations using metaphors to make creative connections. Some ways of doing this are to engage students in finding and elaborating an analogy between a topic under study and something distinct from it. An example from Fogarty et al. (1992) asks students to compare and contrast the structure of the human circularity system with the structure of water and waste services in a city. The systematic comparison of unpacking the analogy by elaboration and extending the thinking will force the transfer of learning between different situations.

(Table 2 content continues on next page)

Table 2. (continued) *Bridging Techniques Defined*

Parallel Problem Solving Parallel problem solving is defined as solving problems with similar structures and content in different contexts; further gaining an understanding for the similarities and contrasts between areas. Some ways of doing this are to engage students in solving problems with parallel structures in two different areas in order for them to gain an appreciation for the similarities and contrasts. For example, Fogarty et al. (1992) had students investigate a (non sensitive) problem in their home environment and a study problem in school, using the same problem solving strategy. The instruction helped students to draw out the parallels and differences.
Metacognitive Reflection Metacognitive reflection is defined as thinking about thinking; planning, monitoring and tracking one's progress, and evaluating one's thinking. Also, metacognitive reflection is being able to control one's thinking and subsequent behavior. Metacognition is being aware, strategic, and reflective in the use of thinking about thinking, and through this knowing, the learner will understand how to approach a task and how to approach it better in subsequent performances. Some ways to do this are to prompt and support students in planning, monitoring, and evaluating their own thinking. For example Fogarty et al. (1992) suggested that after a quiz or any thought-demanding activity, students ask themselves, "What went well, what was hard, and how could I handle what was hard better next time?"

Research Questions

The online co-op preparatory curriculum, with which the first author is associated, was designed to foster the transfer of learning. Thus, the primary research question was: ***In what ways do co-op students enrolled in the university-level online co-op preparatory curriculum show evidence for the thinking skills that underpin the five bridging techniques as outlined by Fogarty, Perkins, and Barrell, (1992): 1) anticipating applications, 2) generalizing concepts, 3) using analogies, 4) parallel problem solving, and 5) metacognitive reflection?***

A second and third research question were also investigated based on the first author's interest in the investigation as a co-op instructor and curriculum developer. The second research question investigated the perceptions of the course facilitators who instructed the learning modules and participated in the online discussions that were analyzed for this study. ***In what ways do the course facilitators understand the thinking skills of co-op students and the transfer of learning?***

The input of employers in co-op programs and curriculums is also highly valued and co-op programs strive for a good articulation between workplace values and academic values. Accordingly, this study also investigated how co-op employer experts valued, in the context of the workplace, the thinking skills as exhibited by the students in the online discussion. Although the co-op employer experts are not necessarily specialists in thinking skills for the transfer of learning, it was their personal view that was of interest to this study to add supplemental information that may have relevance for the curriculum. ***How do co-op employer experts value the thinking skills exhibited by students in the online discussions as useful in a workplace context?***

Method

Participants and data collection. Specific to the primary research question, undergraduate university students from across disciplines who had registered during the Summer and Fall 2009 academic year in a session of the online preparatory program (n=45) were invited to participate in the study; 28 (62.2%) voluntarily agreed. Online discussions were the data source used to address the primary research question investigating thinking skills exhibited by students. Ethical procedures in terms of consent to participate and anonymity were strictly adhered to.

To address the second research question, the first author held discussions with the course facilitators; 100% voluntarily agreed. The course facilitators were asked two question:

1. **What is your perspective about the thinking skills that students are using in the online discussions?**
2. **How do the thinking skills support the transfer of learning?**

To address the third research question, co-op employer experts were asked to complete a short activity; four of nine co-op voluntarily agreed. Co-op employer experts are industry professionals or members of the University's co-op alumni who interact online in an advisory capacity with students. The activity they completed began with a written rudimentary exposure to the concept of transfer of learning and the five bridging techniques as instructional strategies that are capable of supporting transfer. Co-op employer experts were then asked to read excerpts taken from the students' online discussions and asked to indicate for each excerpt if the thinking skills demonstrated were useful in a work context.

Data analysis. A qualitative content-analysis approach was used to address the first research question. Verbatim online discussions were imported into the qualitative data analysis software tool called HyperRESEARCH. A priori codes, derived from Fogarty et al.'s (1992) five bridging techniques (see Table 2) were used. A priori coding was used as the method of analysis to serve the purpose of the research and determine whether thinking skills exhibited in the online discussion were consistent with what is understood about bridging techniques. It was immediately obvious that the five main codes did not make possible a detailed enough inspection of the data and therefore, sub-codes for each a priori code were developed. Table 3 lists the a priori main codes and sub-codes.

Table 3. *Codebook*

Code	*Definition*
Anticipating Applications	
AA1	Demonstrates thinking about upcoming opportunity(s) to use skills, tasks, knowledge, and/or ideas in different general contexts
AA2	Demonstrates thinking about upcoming opportunity(s) to use skills, tasks, knowledge, and/or ideas in different specific contexts
AA3	Demonstrates thinking about how and why skills, tasks, knowledge, and/or ideas are relevant in an upcoming opportunity(s)
AA4	Demonstrates thinking about the adjustments that skills, tasks, knowledge, and/or ideas require in order to make them relevant in an upcoming opportunity
AAF	Facilitator prompts targeted thinking about upcoming opportunity to use skills, tasks, knowledge, and/or ideas
Generalizing Concepts	
GC1	Demonstrates extracting generic idea out of a situation through looking for principles, rules, big picture ideas and/or underlying constructs
GC2	Demonstrates application of generalizable principles, rules, big picture ideas and/or underlying constructs to new context (s)
GCF	Facilitator encourages use of generalizable concepts through looking for principles, rules, big picture ideas and/or underlying constructs
Using Analogies	
UA1	Demonstrates finding, creating, and/or analyzing analogies
UA2	Unpacks the analogy by elaborating on thinking
UA3	Demonstrates using metaphors to compare and find similarities between situations and to make creative connections
UAF	Facilitator prompts creation and/or elaboration on an analogy between differing contexts
Parallel Problem Solving	
PPS1	Demonstrates thinking about similarities between contexts
PPS2	Demonstrates thinking about similarities between contexts and explicitly identifies overlap(s)
PPS3	Demonstrates thinking about contrasts between contexts
PPS4	Demonstrates thinking about contrasts between contexts and explicitly identifies these
PPS5	Demonstrates thinking about how to solve problems with similar structures and content in different contexts
PPSF	Facilitator prompts drawing out of the parallels and differences between contexts
Metacognitive Reflection	
MR1	Demonstrates planning through thinking
MR2	Demonstrates self-monitoring, self-evaluation, and tracking of progress towards goal(s) through thinking
MR3	Demonstrates awareness of and/ or is strategic and reflective (control one's thinking) in thinking about how metacognition may be applied in subsequent performances
MRF	Facilitator prompts and supports planning, monitoring and evaluation of thinking

The first author established intra-coder reliability by doing the coding multiple times and making revisions as necessary. Once the coding scheme was stable, and in order to increase the internal credibility of the coding structure, the first author engaged the second author to code a sample of the data resulting in an inter-rater agreement of 87.2%. Percentage of agreement versus Cohen's kappa was selected for this study based on evidence presented in the literature. Although Cohen's kappa is typically the standard measure of inter-rater reliability for qualitative methods, and thought to be more robust than percentage calculations because it accounts for agreement that may occur by chance, Cohen's kappa has received some criticism for its affinity to take for granted a code's frequency thus resulting in an effect that underestimates the agreement for a code that is commonly used (Mayring, 2000). For these reasons, Cohen's kappa may be viewed as a cautious measure of agreement and was not employed in this study.

The analysis for the second research question involved the compilation of all the notes the primary author had recorded from the discussions with the course facilitators. As with the first research question, a priori codes derived from Fogarty et al.'s (1992) five bridging techniques were used.

The analysis to address the third research question focusing on co-op employer experts is included data in the form of comments and ratings. The comments were also coded using Fogarty et al.'s (1992) a priori main codes and the ratings within each a priori main code were tallied to generate a percentage of agreement among co-op employer experts.

Findings

The findings are summarized in Table 4. The first column of the Table lists the five bridging techniques (the a priori main codes). The next three columns report the findings for the three research questions based on data collected from students, facilitators and co-op employer experts.

Table 4. *The Findings*

A Priori Main Code	*Students*	*Course Facilitator*	*Co-op Employer Expert*
Metacognitive Reflection	Exhibited in 64.83% of total coded excerpts	Facilitators thought that students were able to illustrate evidence of metacognitive reflection showing consistency with findings from the primary data analysis. Course facilitators also cited metacognitive reflection as important for supporting the transfer of learning.	Co-op employer experts found 'evidence for' 66.66% of the total coded thinking skills that underpin the metacognitive reflection bridging technique useful in a work context to help student's transfer their learning.

(Table 4 content continues on next page)

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(Table 4 content continues on next page)

Table 4. (continued) *The Findings*

A Priori Main Code	*Students*	*Course Facilitator*	*Co-op Employer Expert*
Anticipating Applications	Exhibited in 14.66% of total coded excerpts	Facilitators thought that students were able to show some evidence for anticipating applications showing consistency with findings from the primary data analysis.	Co-op employer experts found 'evidence for' 31.25% of the total coded thinking skills that underpin the metacognitive reflection bridging technique useful in a work context to help student's transfer their learning.
Parallel Problem Solving	Exhibited in 11.11% of total coded excerpts	Facilitators thought that students showed some evidence for parallel problem solving in the online discussions.	Co-op employer experts found 'evidence for' 64.0% of the total coded thinking skills that underpin the metacognitive reflection bridging technique useful in a work context to help student's transfer their learning.
Generalizing Concepts	Exhibited in 7.45% of total coded excerpts	Facilitators thought that students showed limited evidence for generalizing concepts as a thinking skill in the online discussions.	Co-op employer experts found 'evidence for' 100 % of the total coded thinking skills that underpin the metacognitive reflection bridging technique useful in a work context to help student's transfer their learning.
Using Analogies	Exhibited in 1.64% of total coded excerpts	Facilitators thought that students were not readily able to show evidence for using analogies as thinking skills and the student's and facilitator's understanding of using analogies was not consistent with what is understood as supporting the transfer of learning.	Co-op employer experts found 'evidence for' 33.33% of the total coded thinking skills that underpin the metacognitive reflection bridging technique useful in a work context to help student's transfer their learning.

Discussion

From the perspective of improving the online co-op preparatory program, it was important and potentially instructive to consider why the variety and frequency of thinking skills were exhibited as they were (see Table 4). Therefore, the discussion will consider the design of the reflective exercises and the perceptions of the course facilitators and co-op employer experts.

Reflection exercises. It is probable that some of the variability that was witnessed in the thinking skills exhibited is attributable to the transfer cueing affordances of the reflection exercises. To verify this, the first author undertook an analysis of the reflection exercises in the online preparatory co-op program in an effort to determine which thinking skills that underpin the five bridging techniques were supported in each reflection

exercise. The result was that some of the reflection exercises afforded more opportunities for some thinking skills over others and this probably resulted in more frequent evidence for that specific thinking skill over the others in that particular reflection exercise. As well, the thinking skills that were the most integrated into the reflective exercises overall also showed up in the data most frequently. In fact, there was a match between the frequency of occurrence of thinking skills that underpin the five bridging techniques in reflective exercises overall (see Table 4) and evidence in the data in the following order (most frequent to least frequent): metacognitive reflection, anticipating applications, parallel problem solving, generalizing concepts, and using analogies.

Therefore, it seems likely that the more affordances a reflection exercise presents to students to elicit thinking skills, the more prevalent the thinking skill will be in the online discussions, making a strong case for the effectiveness of teaching specific thinking skills. This represents a concrete application of the research and advocates for course activities that explicitly prompt the thinking skills required of learners to support the transfer of learning. Curriculum amendments are suggested wherein the reflection exercises afford more equivalent transfer cueing opportunities.

Course facilitator. The course facilitator's ability to encourage the use of the thinking skills is, in the interpretation of the authors, related to the frequency of evidence for that thinking skill. The primary author coded the course facilitators' discussions and the outcome was that course facilitators reported that they:

- encouraged metacognitive reflection which likely contributed to the strong evidence of that thinking skill by the students,
- somewhat equally encouraged anticipating application and parallel problem solving which likely contributed to the approximate equal evidence of those thinking skills by students, and
- very infrequently encouraged generalizing concepts and did not prompt using analogies which likely contributed to the weak evidence of these thinking skills as exhibited by the students. Course facilitators reported that they had limited understanding about the concept of using analogies to foster the transfer of learning.

Therefore, it seems likely that the greater the course facilitator's knowledge about the thinking skill and their value for it, the more likely they will be able to elicit it in students. This represents a concrete application of the research and advocates for strong training of the knowledge required by course facilitators in order to enhance their ability to foster the learners' thinking skills for the transfer of learning. Curriculum amendments are suggested for the training program to ensure that course facilitators are knowledgeable of the requisite instructional strategies.

Co-op employer experts. The co-op employer experts' perceptions of the thinking skills that are useful in a work context to help student's transfer their learning adds supplemental information that potentially deepens the implications for the curriculum. The think-

ing skills exhibited by students that were rated by the co-op employer expert as most to least useful in a work context to help student's transfer their learning were (see Table 4): generalizing concept, metacognitive reflection, parallel problem solving, using analogies, and anticipating applications.

The students however exhibited evidence for the thinking skills in the following order of most to least frequent (refer to Table 4): metacognitive reflection, anticipating applications, parallel problem solving generalizing concept, and using analogies.

In summary, the thinking skills that the co-op employer experts perceived as most useful in a work context to help student's transfer their learning differed from the thinking skills exhibited by the students. As such, based on the perspective of the co-op employer experts, the interpretation made by the authors is that the curriculum may need to provide more affordances for specific thinking skills in order to enhance the alignment of the curriculum with what employers perceive as useful in assisting students with the transition from an academic to workplace context.

Implications For Practice

Using the bridging techniques as a framework to discuss how education for the transfer of learning can be implemented, the following implications for practice are made. The authors' recommendations are to increase affordances in course activities that will amplify opportunities for students to be able to practice and demonstrate the thinking skills. Specifically, opportunities to discuss anticipating applications, parallel problem solving, generalizing concepts, and using analogies need to be explicitly written more often into the course activities. Another application is developing a training program for course facilitators that provides knowledge about instructional strategies that support their role. The training program should aim to enhance their ability to prompt the thinking skills in learners, especially with respect to the use of using analogies, which was evidenced poorly in the online discussions.

The good news is that properly designed course materials can elicit the desired thinking skills that will enhance students' ability to transfer their learning.

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