Proceedings of the Informing Science + Information Technology Education Conference

An Official Publication of the Informing Science Institute
InformingScience.org

InformingScience.org/Publications

July 31 - August 5, 2017, Ho Chi Minh City (Saigon), Vietnam

A KNOWLEDGE MANAGEMENT IT TOOL: AN INVESTIGATION WITHIN A MARKETING INTRODUCTORY COURSE

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ABSTRACT

Aim/Purpose	The purpose of this study is to shed light on how students learn within an environment tailored to knowledge creation.
Background	We build on Nonaka, Toyama, and Konno's three key elements: SECI model, Ba, Leadership as well as current knowledge management researchers critiques and improvements.
Methodology	Based on an introductory marketing course, we used an in-house web based learning tool (peer-to peer) to capture score performances and perception surveys. The analysis was conducted through an exploratory factor analysis (EFA).
Contribution	This study shed light on current knowledge management critiques by providing measures at the micro-level and community level.
Findings	Perceptions of adaptability and usefulness change positively over time, while students' repeated practice prepares them for different styles of questions as their performances increases over time.
Recommendations for Practitioners	Organizations can understand how employees create knowledge through exchange of ideas, feedback, and common goals. Supervisor can understand their employees better and employees can gain a sense of control on their work.
Recommendation for Researchers	The ability to capture information over time on the human and community level within a system allows further research to shed light on different variables of knowledge creation in the field.
Impact on Society	An appreciation of the mechanism of knowledge creation can encourage organization to become more innovative and focus on people rather than material.

Accepting Editor: Eli Cohen | Received: December 7, 2016 | Revised: March 14, 2017 | Accepted: January 2, 2017

Cite as: Ly, S. L. S., & Saadé, R. G. (2017). A knowledge management IT tool: An investigation within a marketing introductory course. *Proceedings of the Informing Science and Information Technology Education Conference*, *Vietnam,* pp. 171-182. Santa Rosa, CA: Informing Science Institute. Retrieved from http://www.informingscience.org/Publications/3697

Future Research	Measures such as the engagement level, the personality level, and compatibility level within a community to create knowledge are to be explored.
Keywords	immersive learning, collaborative learning, marketing

INTRODUCTION

Immersive learning has been a popular theme to explore in the literature; very often researchers have focused on the improvement of tactile skills and virtual reality graphics. However there seems to be a lack of focus on knowledge acquisition. In this paper, we would like to emphasize existing knowledge management models, mainly on Nonaka, Toyama, and Konno's (2000) work, prominent researcher's critiques (Gourlay, 2006), and suggestions (Harsh, 2009; Jakubik, 2011; von Krogh, Ichijo, & Nonaka, 2000) within a high engagement level environment, which we define as an immersive learning context.

In response to the importance of Information Technology today, we believe it plays a crucial role in enhancing learning environments. We channeled and measured students learning and knowledge management using a web-based learning tool with immersive features. This tool was presented to a classroom of 113 non-business students from 41 disciplines (from computational arts and economics to child studies) during an introductory marketing course. As a result, we were able to observe performance over time and investigate students' perception of their adaptability and the usefulness of this immersive learning tool.

THEORETICAL FRAMEWORK

Current research in knowledge management has revised Nonaka et al.'s (2000) SECI model and suggested modifications as well as improvements. The SECI Model is defined as the mechanism of externalizing and internalizing, therefore transforming tacit (unconscious) knowledge to explicit (conscious) knowledge. There has been an apparent shift towards more dynamic knowledge management models where three overarching themes have appeared in the literature. Gourlay, (2006), Heisig, (2009), Nonaka (2008) mentioned that in order to achieve high quality knowledge management, it is important to understand human factors and behaviors at the micro level of interactions. On the other hand, Cook and Brown (1999), Sun (2010), Tsoukas (2005), von Krogh et al. (2000, pp. 3-44), and Zboralski (2009) focused on the need to look at enabling factors within a context, more specifically within a community, to understand how knowledge is created. As the third theme, building on Nonaka et al.'s (2000) identification of a "ba" environment for knowledge creation, Gourlay (2006), Stacey (2001, and Senge and Scharmer (2011) questioned transformational changes in knowledge creation while Bernier and Bowen (2004) experimented with creating an environment and testing its control and agility of knowledge development in a virtual setting (Harsh, 2009). The "ba" environment is thought of as an environment for knowledge creation purposes, whether physical, virtual, or mental. The concept was first proposed by Kitaro Nishida, then further developed by Shimizu and completed by Nonaka et al. (2000).

Researchers such as Hardaker and Smith (2002), Heisig (2009), Jakubik (2011), and Nonaka (2008) acknowledge the field of knowledge management has shifted and reached a new phase where the acquisitions of concepts need to be human-focused, mainly people, culture, and leadership. To support their claim, Jakubik (2011) defined the micro-level perspective of human behavior and engagement by mentioning the topic of immersion centered interaction based on psychologist Csikszentmihalyi's (1991, pp. 88-89) flow theory. Similarly, Senge and Scharmer (2011, p. 247) believed knowledge creation is an "intensely human, messy process of imagination, invention and learning from mistakes, embedded in a web of human relationships".

Based on Csikszentmihalyi's (1991) interpretation of flow experience, individuals share common clear goals with meaning to their experience: they receive feedback, they experience interactions that create feelings, they have a sense of control over the feeling of possibilities of choices and new

things. More importantly, each individual has an intrinsic motivation and commitment where mistakes are treated as a learning process and challenges arise to push their limits. Csikszentmihalyi (1991) created the concept of full engagement in an activity which includes losing the sense of time and defined as the flow experience.

"The focus on human is not enough", mentioned Jakubik (2008), not only does the focus need to be at a micro-level, the scope should be contextual. Wenger & Snyder (2000) state ". . . groups of people informally bound together by shared expertise and passion for joint enterprise [. . .] While Jakubik, (2008) mentioned "People in communities of practice share their experiences and knowledge in free-flowing, creative ways that foster new approaches to problems."

von Krogh et al. (2000) interpreted Nonaka and Takeuchi's (1995) SECI model differently when describing the transformation in the focus of content, such as capturing, locating, transferring, sharing existing knowledge to contexts of knowledge creation, taking into account enabling conditions (instill a vision, manage conversations, mobilize activists, create the right context, globalize local knowledge) that result in increased new innovations. This is in line with Hardaker and Smith's (2002) thoughts on a missed opportunity from learners to participate in an exchange of ideas where the appropriate level of interactivity is meaningful. This problem can now be answered via social communities enabled by the advancement of Information Technology (IT) which they could do not in the past.

Overall, the purpose of our study is to explore the combined fields of knowledge management through the SECI Model mechanism while investigating on the flow of engagement within the confines of a "ba" environment where students have the opportunity to create knowledge and collaborate with their peers.

METHODOLOGY

THE CONTEXT

During the semester of Fall 2016, in an undergraduate course in Marketing at the John Molson School of Business, Concordia University, Montreal, Quebec, Canada, we presented to 113 enrolled students a learning system called Peer to Peer System (p2p). The class consisted of non-business background students from computational arts to child studies majors. This course served as an elective where students learn basic concepts of marketing such as business strategy, pricing models, segmentation, branding, and digital marketing. Many students have an interest in trying a course from a different field, while others have the motivation to pursue a bachelor's degree in business in the near future. The learning objectives were based on an understanding of basic concepts in theory, the ability to write and structure a marketing report, the ability to research primary and secondary data, and the knowledge to apply theories to a real-life company.

In an effort to study for their midterm exam and final exam made of essay questions and multiple choice questions on concepts and applications, students were asked to use the p2p system on an optional basis in two instances throughout the semester, once before the midterm and once before the final exam.

The students were informed of this at the beginning of the semester as part of their course outline. The activity was an optional exercise to help them study for upcoming examinations. Students were informed that the purpose of this study was to observe their level of engagement through a 3 step process of creation, evaluation, and testing. Their researcher investigating this study was also the professor of the course. On the evaluation side, students' tests were graded automatically by the system when they were multiple choice questions, and graded manually when it was essay questions.

The experimental method used in this class was first piloted in a doctoral classroom during Fall 2014, a masters level course in Fall 2015 and Winter 2016. After previous modifications and developments on the computer system, this experiment is considered the 5th iteration of the investigation.

THE PROCESS

The p2p system was designed as an in-house research oriented learning tool to access students' abilities to create knowledge. This system is regularly improved. The p2p system allows for students to actively participate in the creation of questions within a social context where their peers provide feedback on the quality, clarity, and relevance of their ideas. Students follow a 3 phase process. In Phase 1, students are given a specific amount of time to review their learning material on marketing concepts based on lectures and their book. When ready, they are required to submit a predetermined number of questions (in this case, 5 multiple choice questions with 5 answer options, 1 easy, 2 medium, 3 hard). Once submitted, the teacher moves the cohort to phase 2. In Phase 2, the p2p tool randomly provides each student with a predetermined number of questions generated by their peers. They proceed to evaluate each question with a rubric of relevance, clarity, and difficulty on a scale of 1-10 (low to high). The system also ensures students will not receive their own questions. The p2p system consequently stores evaluated questions, which represents a body of knowledge learnt by the students. Once questions have been assessed, the teacher closes the phase. Arriving at Phase 3, the teacher views all questions created; through sorting based on their preferred criteria, the teacher generates one or more tests from the pool of student generated questions in the format of a quiz or a test. Questions are sorted and selected based on higher quality (clarity, relevance) and three difficulties (easy, medium, hard).

Given each student profile includes students' ethnic background and gender, the teacher has the option of specifying sub pools of questions for students to take and from students who created.

EXPERIMENTAL DESIGN

This study looks at two perspectives of knowledge creation amongst students: their perception of the p2p system and their performances using the p2p system as a training/collaborative platform.

In part 1, students were asked to complete a questionnaire at two instances: after their midterm p2p activity, and after their final p2p activity. The questionnaire was based on Davis, Bagozzi, and Warshaw's (1989) perceived usefulness and ease of use of professional software on a 7-point likert scale. Through an exploratory factor analysis (EFA), we try to determine significant construct(s) which we believe will be close to Davis et al.'s (1989) "perceived usefulness" and "ease of use" in order to understand students' perceptions of the system. We will then be able to compare two sets of data over two periods of time and identify whether changes in perception occurred. The EFA was used in order to explore different factors and construct available. Although this scale was previously used for computer adaptability, we are now exploring the possibilities of have a designed computer assisted learning space, hence starting with an exploration rather than a confirmation of constructs would be a better fit.

In part 2, we would like to quantify students' performances to see whether reusability and redundancy increases performance for students. At four instances, they were tested on their ability to answer multiple-choice questions. First, two tests were created during their midterm p2p activity. One week later, they were given 20 questions in their midterm exam, 10 from the pool of peer-to-peer questions generated and 10 from a teacher-made pool of questions. Within a pool of 130 questions generated at the midterm p2p activity, 40 questions of highest quality, relevance, clarity, and rating were selected and 10 were drawn for the midterm exam. On the other hand, the teacher also created a pool of 15 questions where 10 were randomly drawn from for the midterm. The methodology used in part 2 involved mapping out the scores of students to observe trends of performances on four tests. The longitudinal method of analysis was relevant in this case given data was taken at multiple periods of time throughout the semester. A basic descriptive statistical observation and a longitudinal analysis on the progression of students' performances seem to fit.

The data collection process was designed through-out the system to have the ability to export consolidated data such as the performance scores of students, the time used to complete the test, the num-

ber of questions generated and their related answer choices. At the end of the experiment, the research extracted the data automatically from the program. There were two types of data, for part 1, questionnaire answers were extracted through an Excel sheet which allowed the analysis. On the other hand, for part 2, the 3 phases data sets were automatically consolidated and extracted as an Excel sheet after the event.

RESULTS & ANALYSIS

PART 1 – EXPLORATION ON STUDENTS SURVEY ABOUT THE KNOWLEDGE CREATION TOOL

With an Exploratory Factor Analysis (EFA), we were able to detect three constructs, based on the set of items, which we named as Adaptability, Perceived usefulness, Future Use for the midterm phase, and two constructs (Adaptability, Perceive usefulness) for the final exam phase. In order to confirm statistical assumptions, we ran two Bartlett's tests, which were respectively significant showing there is equal variance within in variable.

The Cronbach alpha for all 5 constructs were highly significant, meaning each item from the survey explained the construct well. Specifically, Adaptability- 6 items (midterm) yield Cronbach alpha α=.918, Perceived Usefulness-4 items (midterm) α =.899, Future use-2 items (midterm) α =.927, Adaptability- 6 items (final) α =.955, Perceived Usefulness-6 items (final) α =.936. All constructs were well explained by their respective items (Table 1 & Table 2).

Table 1. EFA summary for Midterm Exam Constructs

Code	Midterm Exam Components, sample of 71	Cronbach Alpha if item deleted	Item total correlation
	Adaptability		
A1M	My interactions in P2P Program is clear and understandable.	.912*	.680
A2M	I am skillful at using P2P Program.	.904*	.759
A3M	Learning to use the P2P Program is easy for me.	.894*	.873
A4M	I find it easy to get the P2P Program to do what I want it to do.	.898*	.825
A5M	I have the resources necessary to use the learning systems (websites) at the university.	.896*	.825
A6M	I have the knowledge necessary to use the learning systems (websites) at the university.	.905*	.751
A7M	A specific person (or group) is available for assistance with learning systems (websites) difficulties.	.925*	.556
	Cronbach Alpha for the 6 items = .918; Mean (SD) = 5.249 (.062)		
	Perceived Usefulness		
U1M	I find the P2P Program useful.	.870*	.773
U2M	Using P2P Program enables me to accomplish learning tasks more quickly.	.899*	.704
U3M	Using P2P Program increases the effective use of my time in handling learning tasks/assignments.	.840*	.857
U4M	Using P2P Program increases the quality of my learning tasks at minimal efforts.	.868*	.777
	Cronbach Alpha for the 4 items = .899; Mean (SD) = 5.018 (.063)		
	Future Use		
F1M	I intend to continue using the P2P system.	N/A	.865
F2M	I predict that I would use the P2P system in the future.	N/A	.865
	Cronbach Alpha for the 2 items = .927; Mean (SD) = 4.817(.004)		
*significant			

Table 2. EFA summary for Final Exam Constructs

Code	Final Exam Components, sample of 20	Cronbach Alpha if item deleted	Item total correlation
	Adaptability		
A1F	My interactions in P2P Program is clear and understandable.	.949*	.832
A2F	I am skillful at using P2P Program.	.946*	.870
A3F	Learning to use the P2P Program is easy for me.	.948*	.842
A4F	I find it easy to get the P2P Program to do what I want it to do.	.944*	.918
A5F	I have the resources necessary to use the learning systems (websites) at the university.	.946*	.874
A6F	I have the knowledge necessary to use the learning systems (websites) at the university.	.945*	.883
A7F	A specific person (or group) is available for assistance with learning systems (websites) difficulties.	.958*	.725
	Cronbach Alpha for the 6 items = .955; Mean (SD) = 5.600 (.029)		
	Perceived Usefulness		
U1F	I find the P2P Program useful.	.921*	.846
U2F	Using P2P Program enables me to accomplish learning tasks more quickly.	.916*	.876
U3F	Using P2P Program increases the effective use of my time in handling learning tasks/assignments.	.919*	.854
U4F	Using P2P Program increases the quality of my learning tasks at minimal efforts.	.946*	.663
U5F	I intend to continue using the P2P system.	.922*	.834
U6F	I predict that I would use the P2P system in the future	.923*	.820
	Cronbach Alpha for the 4 items = .936; Mean (SD) = 5.175 (.041)		
*significant			

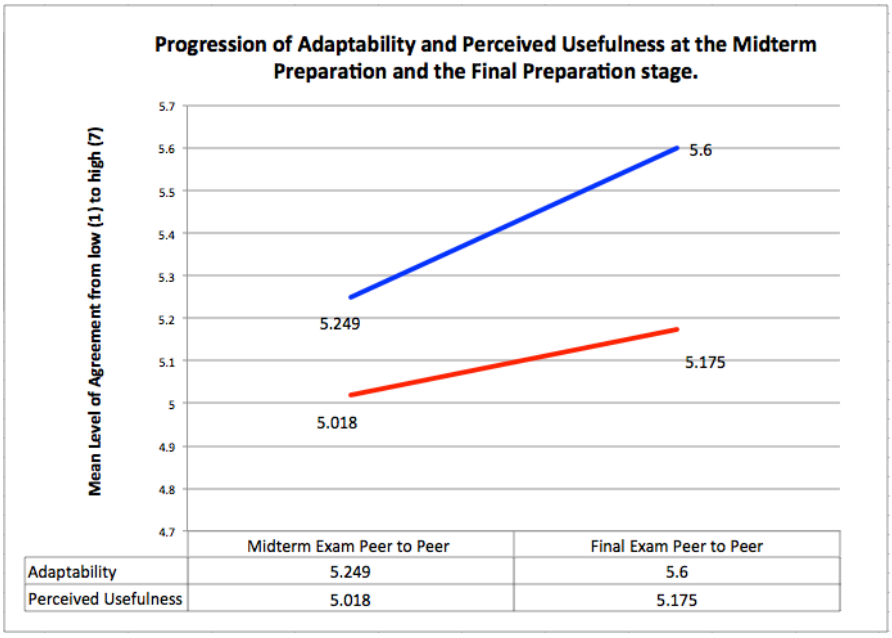

Figure 1. Comparison of means from midterm to final phase on adaptability and perceived usefulness

Based on the factor analysis means (Figure 1), we can see both common constructs (adaptability and perceived usefulness) have increased from the midterm to the final exam. Due to their repeated use of the p2p system, the students found the tool to be more useful and easier to adapt to. Moreover,

the two-item construct of Future use is relevant as 47% of students foresaw using the system again while 27% said maybe, and 27% did not foresee using the system again (Figure 2).

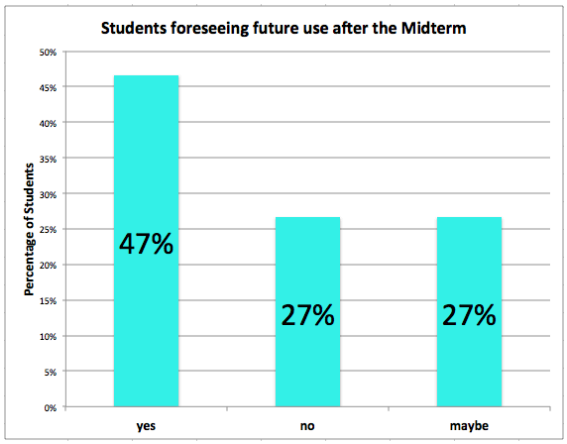

Figure 2. Summary of results for Future use construct at the midterm phase

We then considered individual average factor values and interpreted the transformation in perception from midterm to final. When looking at individual responses we identified the following:

1. "drop in confidence" when their midterm to final response decreased
2. "reinforcement in confidence" when their midterm to final response increased
3. "consistent confidence" when their midterm to final response stayed the same.

The results show that 40% of students who dropped in confidence can be interpreted as being aware of their knowledge and taking failure as a learning process. On the other hand, 47% of students became more confident which can be seen as a sign of opportunity to study using a learning tool and a sign of participating in an exchange of ideas (Figure 3).

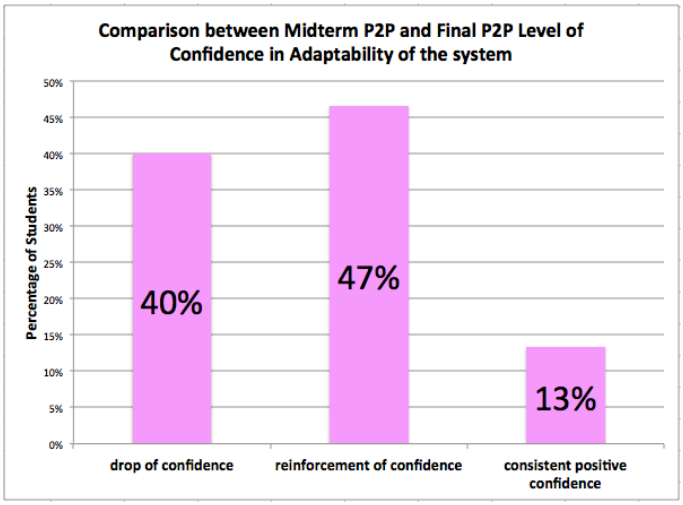

Figure 3. Summary of confidence in Adaptability of the system over time.

In addition, we interpret individual average factor scores on the construct of usefulness with the following:

1. If the midterm to final score decreased, students found the system to be less useful over time
2. If the midterm to final score increased, students found the system to be more useful over time

3. If the midterm to final score stayed the same, students' perceived usefulness did not change over time.

33% of students did not change their perception over time, while 40% of student found the p2p tool to be more useful and 27% found the p2p tool to be less useful over time (Figure 4). These results help us understand at an individual level the effectiveness of the p2p tool.

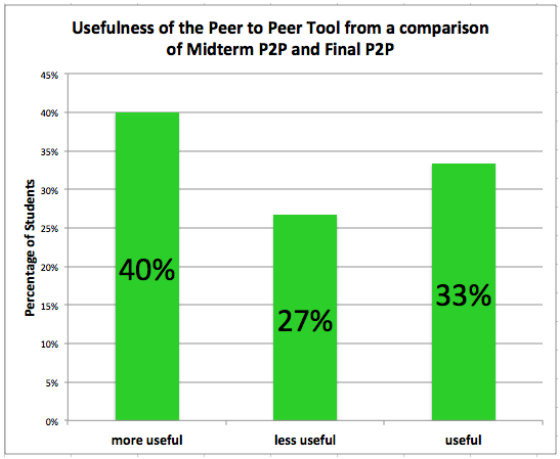

Figure 4. Summary of perceived usefulness of the system over time.

PART 2 – ANALYSIS OF A 4 STAGE PROCESS IN KNOWLEDGE REUSABILITY AND TIME

In part 2 we were able to observe the performance in test scores of a sample of 20 students in the course at four instances. First during their p2p midterm activity, they were asked to complete two tests (p2p trial 1, p2p trial 2), then one week later, students were given 10 random questions pooled from the p2p activity filtered with higher quality and 10 questions randomly pooled from a teacher created bank.

Looking closely at the performances of 20 students in the course, we can see a larger fluctuation of the first two trials (p2p trial 1 and p2p trial 2) where their standard deviations varied respectively 17.86% and 24.27% meaning there is a larger distribution of the grades amongst students, some are scoring higher and some lower. Interestingly, the performance of the p2p midterm questions increased with a mean of 91.7% and a reduction in the standard deviation to 8.045%, which shows that as a whole, the group became more consistent in scoring with fewer fluctuations. The lowest score for the p2p midterm was 70% which is considered high.

On the other hand, the performance of students increased less when faced with teacher created questions where students averaged a score of 74.5% with a smaller fluctuation of a standard deviation of 17.06%. The teacher created questions were designed to create control and investigate on whether students learnt concepts or memorized multiple choice question structures. It is apparent that the two p2p trials where students studied based on the pool of 130 questions helped them perform on similar style questions at the midterm as the p2p midterm questions. However, when faced with teacher created questions, students were uncomfortable with a new style and a new language different from their peers on the same concepts. Interestingly, they performed better overall, which suggests the peer-to-peer preparation prepared them for both types p2p and teacher made at the midterm exam.

	p2p trial 1	p2p trial 2	p2p mid	teacher mid
1	87%	83%	100.00%	80.00%
2	87%	90%	85.00%	50.00%
3	52%	32%	90.91%	90.00%
4	83%	73%	88.24%	70.00%
5	43%	85%	90.00%	70.00%
6	57%	44%	100.00%	90.00%
7	78%	90%	80.95%	40.00%
8	84%	80%	89.47%	100.00%
9	63%	100%	70.00%	60.00%
10	79%	85%	100.00%	90.00%
11	58%	88%	90.91%	80.00%
12	78%	62%	100.00%	90.00%
13	47%	25%	88.24%	70.00%
14	26%	59%	100.00%	70.00%
15	79%	100%	100.00%	90.00%
16	74%	55%	88.89%	80.00%
17	96%	81%	80.95%	90.00%
18	79%	86%	90.91%	50.00%
19	63%	38%	100.00%	50.00%
20	57%	30%	100.00%	80.00%

Figure 5. Progression map of student performances

Table 3. Description Statistics of each testing stage.

	p2p trial 1	p2p trial 2	p2p mid	teacher mid
Mean	68.5%	69.3%	91.7%	74.5%
SD	17.86%	24.277%	8.405%	17.06%
N	20	20	20	20
Min	26%	25%	70%	50%
Max	96%	100%	100%	100%
Pool of Questions	130	130	40	15

Finally, when asked what method of study would they actually use the p2p tool for (Figure 6), students responded mostly (59%) to study for an exam at the midterm, the percentage increased to 70% at the final preparation stage. On the other hand, while 19% found the system useful to learn in regular classes, the percentage decreased to 5% at the final preparation stage. They overall believe it is useful for exam studies, sometimes in group studies and tutorial but not too much to learn in regular classes.

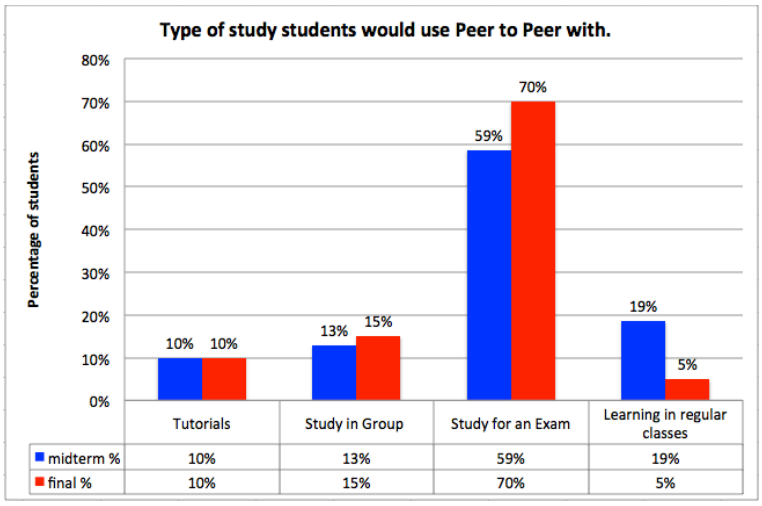

Figure 6. Type of studying method students see the use for p2p

DISCUSSION

Overall, based on our results and analysis, part 1 of the experiment allowed us to look at the adaptability and perceived usefulness of the "ba" environment in order to create a positive learning system It was also pertinent to see the rise in improvement from students practicing over time. The contribution of these results allows us to gain a further understanding of introducing a knowledge creation environment (the p2p) to university level students while implementing technology at the human level. Part 1 considered constructs of adaptability and usefulness of technology, which contributes to the relevance of today's learning world, while part 2 allowed us to gather information on the types of learning method students are comfortable in and would want to adopt in their own learning.

A further understanding of the context, in this case a cohort of students enrolled in an introductory marketing class with the common social goal of studying for their examinations, allows us as researchers to investigate on the micro-level and community context. We found a variety of factors through this study allowing us to explain the context of knowledge creation in this cohort with measures of confidence in usage, perceived usefulness, adaptability, and future use. An aggregate measure individuals' perception showed the ease of use and confidence have increased over time from midterm to final period.

In addition, we question, based on student performances, whether the speed to knowledge acquisition can be increased via a learning system similar to the peer to peer where students learn by collaboration, sharing, and documenting their knowledge with other students. This brings in an interesting topic of time of knowledge acquisition, which Harsh (2009) alluded to where time/efficiency in learning allows for reusability of knowledge. In our case, knowledge was reused (pool of p2p question used in the midterm); students performed significantly better with similar questions, but also were able to perform with a different style of questions (teacher made).

Although a lot of work needs to be done in this scope of knowledge management and knowledge creation, this study sheds light on how students gain an ability to detect and create useful knowledge that allows increased efficiencies in their knowledge creation.

CONCLUSION

The p2p learning tool presents to all stakeholders of knowledge management (the teacher, researcher, and students) a process of measurement at the micro-level while considering human factors through recorded data such as time of completion, performance scores, customized test creation. Moreover, the p2p learning tool also offers social context features such as p2p feedback, and automa-

tion with teachers' dashboard view of the cohort as a whole, which enables statistical analysis. Through an immersion centered learning experience as defined by Csikszentmihalyi (1991, pp. 88-89), and a teacher led activity, students are given the freedom to create new ideas: they are provided a social context with a common mission, they receive feedback (phase 2 of p2p), they experience feelings (through questionnaire answers), and they gain a sense of control on their own knowledge acquisition (phase 1 of p2p).

This study therefore addresses a few of the concerns raised by knowledge management researchers and fill in the gap in improvements of knowledge management at the foundation of Nonaka et al.'s (2000) SECI model of transforming tacit knowledge to explicit knowledge (mechanism), Ba, a platform to advance collaboration and knowledge sharing (peer to peer learning tool), and individuals led in a social context of learning through leadership (person).

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Dr. Raafat George Saadé has been teaching in JMSB since 1998. He obtained his PhD in 1995 (Concordia University) after which he received the Canadian National Research Council (NSERC) postdoctoral fellowship, which he completed at McGill University in Montreal. Dr. Saadé has extensive industry experience: research project manager, product developer and supply chain manager, operations manager, project leader, and information systems designer. Since 2000, he was also a consultant to the Canadian International Development Agency (CIDA) providing advice on international projects in Ukraine, Pakistan, and Slovenia. In the past 3 years, Dr. Saadé has been a senior advisor at the International Civil Aviation Organization (ICAO) providing input on strategic planning for organizational change. Dr. Saadé has published in top tier journals such as Information & Management, Decision Sciences, Education and Computers, Decision Support Systems, Computers and Behavior, Journal of Information Technology in Education, and Expert Systems with Applications.