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### Course design based on enhanced intercultural transformation theory (EITT) Transforming information systems (IS) students into inventors during academic exchange Sivakumar, Chitra; Kwok, Ron Chi-Wai

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## Course Design based on Enhanced Intercultural Transformation Theory (EITT): Transforming Information Systems (IS) Students into Inventors during Academic Exchange

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### Abstract:

In this paper, we propose the enhanced intercultural transformation theory (EITT) with additional factors (i.e., support and motivation) as an extension to the existing intercultural transformation theory (ITT). Based on the EITT, we propose a three-phased (i.e., learner, explorer and inventor) framework of an exchange experience assessment (EEA) course with all five EITT factors (i.e., stress, adaptation, growth, support and motivation) interfaced with three stakeholders (i.e., student, patent advisor and instructor). Also, we report the design of the EEA course and its implementation in a university. The collected data confirmed our proposed EITT and EEA course framework that helped to transform information systems (IS) students into inventors. We found that students could develop patentable inventions through the stress-adaptation-growth process during their academic exchanges, but they still needed the patent advisors' and instructor's support and motivation. Our findings can enable any interested faculty in any university to attempt offering a similar course for the benefit of budding undergraduate inventors during academic exchange.

**Keywords:** Academic Exchange, Patent, Student Invention, Intercultural Transformation Theory, Adaptation.

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## 1 Introduction

A dynamic process called the stress-adaptation-growth as defined by intercultural transformation theory (ITT) (Kim & Ruben, 1988) states that students grow during intercultural encounters. The adaptation process improves problem-solving skills (Cohen, 2011). The capability to identify new solutions to problems requires “thinking out of the box”, looking at things from a new angle, venturing off the beaten path, and risking failure leading to creativity (Sursock, Riegler, & Scheuthle, 2007). Thus, when students are put in a new environment, they tend to think creatively because they would have never thought about the implemented ideas in the environment they grew up in. However, research has consistently found that passive exposure to different cultures (e.g., a slideshow presenting two cultures simultaneously) seems to be relatively unhelpful and that individuals need some sort of comparison between cultures for the adaptation process to impact creativity (Maddux, Leung, Chiu, & Galinsky, 2009).

Businesses today—especially information systems’ (IS) organizations as globalization enablers—need new employees who are globally aware (Harris, Murray, & Urbaczewski, 2011). Research has recognized that multi-national firms need to understand cultural and national effects on the use and management of IT (Harrison & Farn, 1990). Sharifi and Javadi (2011) mention that globalization brings changes in the nature of the market, science’s rapid advancement, the human need for re-learning, the limitations of available resources, increasing demands for flexible learning opportunities, the creation of novel borders for understanding, and exchanging information between cultures.

In this paper, we report on a course we designed called “exchange experience assessment (EEA)”, which we based on our proposed enhanced intercultural transformation theory (EITT). This EEA course could support and motivate IS students to create inventions in new environments during their academic exchanges. Also, this EEA course gives IS students an active exposure to different world cultures and transforms them into inventors during their academic exchanges. More specifically, EEA is a three-credit unit course that students’ home universities offer. The students have to complete the EEA course during the double academic exchanges (one in Asia and another one outside Asia) in their hosting universities. In the EEA course, IS students need to create two inventions (i.e., utility design and business method) to meet the course requirements with the support and motivation that patent advisors and the instructor provides.

This paper builds on Chitra, Ron, and Hao (2016) and proceeds as follows. In Section 2, we briefly describe our proposed EITT. In Section 3, we present our EEA course design based on EITT. In Section 4, we present the evaluation method and introduce the stakeholders and their comments about the various aspects of the course design. In Section 5, we show example student inventions. In Section 6, we discuss our findings, the challenges we experienced in implementing the EEA course, our study’s limitations, and possibilities for future research. Finally, in Section 7, we conclude the paper.

## 2 Enhanced Intercultural Transformation Theory (EITT)

The extant literature shows that intense social, economic and technological changes have led to studies on enhancing creativity (Craft, 2001; Shaheen, 2010). Research conceives creativity as a basic requirement for individuals’ survival and for future success (National Advisory Committee on Creative and Cultural Education, 1999), and multicultural experiences influence individuals’ creativity. Those students who decide to go abroad have their own expectations. Once they land alone in a new environment with a different culture, they may experience cultural shock and anxiety that results from losing many familiar signs and symbols of social intercourse (Oberg, 1960). Students may feel lonely or get home sick from these experiences.

According to the conceptual foundation of stress-coping theory, individuals experience stress based on how they understand negative outcomes when experiencing a new culture (Folkman & Lazarus, 1985; Lazarus, 1993). Stress-copying theory identifies and describes both psychological and sociocultural adjustment, the two major types of adjustment that individuals typically experience.

An adaptation, such as intercultural adjustment, represents a life change accompanied by misunderstandings, uncertainty, and failed expectations. Adaptations are typically quite stressful. Researchers have treated adaptation as a dependent variable and examine factors that predict successful adaptation. Researchers have considered factors such as social support and self-efficacy (Tsang, 2001), communication competence, and other language-related skills (Zimmerman, 1995), interaction with host

members (Tsang, 2001; Ward & Kennedy, 1993), and personality (Tomich, McWhirter, & Darcy, 2003; Tsang, 2001) to significantly predict adaptation.

Kim and Ruben's (1988) intercultural transformation theory (ITT), on the other hand, describes a sojourner's role as dynamic and self-reflective and as requiring frequent adjustments to adaptation. This process of coping with adjustments provides the sojourner with experiential lessons, which allows the individual to grow into a more skilled and knowledgeable individual.

Based on stress leading to growth during intercultural encounters and multicultural experience leading to creativity, we examine the following questions: "Can an EEA course spur students' creativity and transform them into inventors?", "How can one motivate IS students to be creative?", "Do students need any support?", and "Who can support them?".

By introducing the EEA course, we postulate that, while IS students live outside their culture, they will try to explore issues of the encountered stress in the new culture. Furthermore, when they receive appropriate motivation and support, students can take up the challenge to create ideas and inventions to adapt to the new culture, which leads to growth. Also, we add two additional factors (i.e., support (for enhancing the individual's knowledge and thinking styles) and motivation (for boosting students' exchange experiences and quality of creative inventions) to the intercultural transformation theory (ITT), which expands on its existing three factors (i.e., stress, adaptation, and growth). We call this updated theory the enhanced intercultural transformation theory (EITT) (see Figure 1).

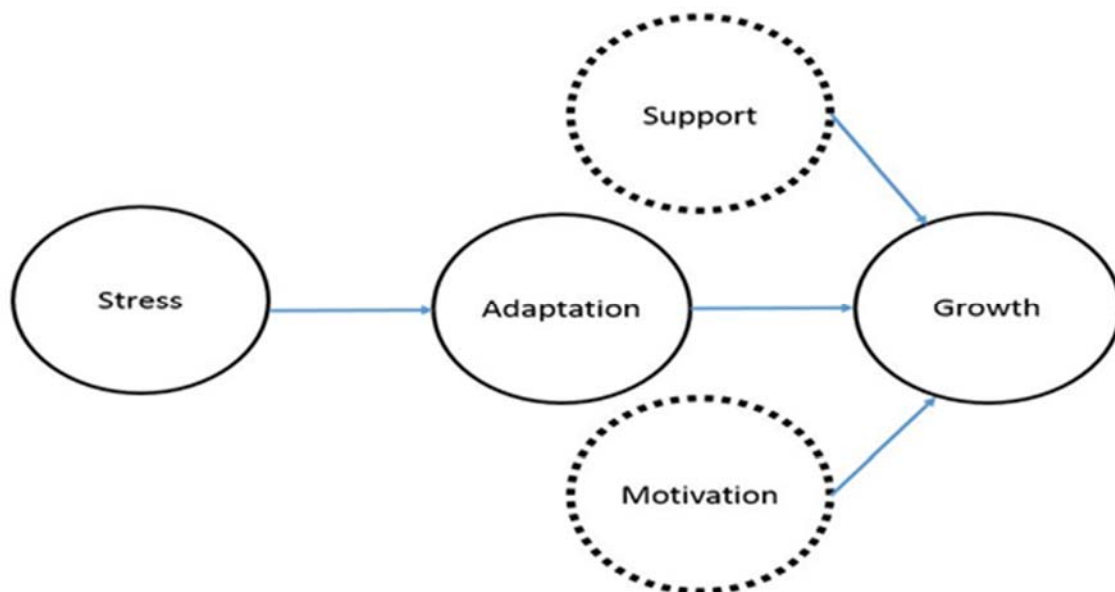


Figure 1. Enhanced Intercultural Transformation Theory (EITT)

### 3 Course Design Based on EITT

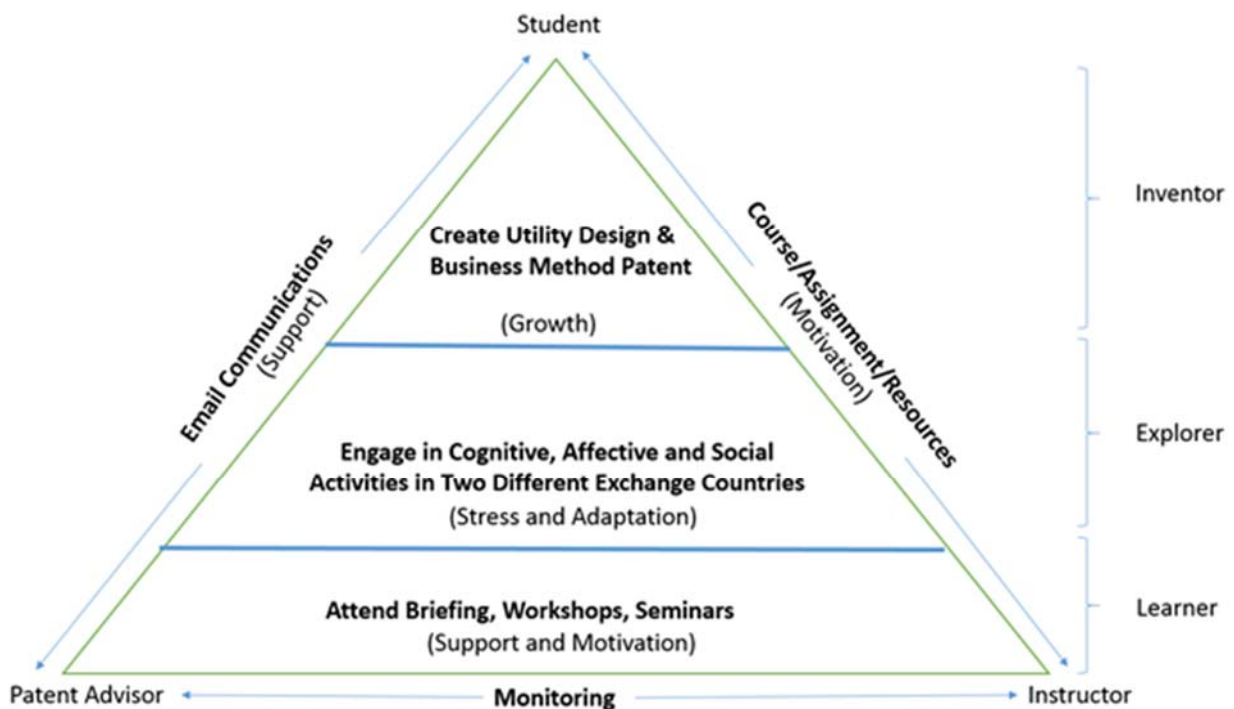
Core characteristics for creativity in higher education include originality, appropriateness, (Amabile, 1996; Csikszentmihalyi, 1996; Gardner, 1993; Taylor, 1988), future orientation, and problem-solving ability (Kaboodi & Yeo, 2012). Creativity researchers contend that one can learn and teach creativity through proper training programs with educators' conscious contributions and creativity-friendly environments (Davis, 2006; Reese & Parnes, 1970; Saracho, 2002). Some supporters suggest that creative thinking and training pedagogy should blend into curricula with a more pluralistic approach that can help students to incrementally produce more and better quality creative ideas (Lau, Ng, & Lee, 2009; Parnes & Meadow, 1959; Puccio & Keller-Mathers, 2007).

Leung, Maddux, Galinsky, and Chiu (2008) found that extensiveness of multicultural experiences was positively related to both creative performance (insight learning, remote association, and idea generation) and creativity-supporting cognitive processes (retrieval of unconventional knowledge, recruitment of ideas from unfamiliar cultures for creative idea expansion). Furthermore, they note that people learn new ideas and concepts from multicultural experiences. Through multicultural experiences, people are also exposed

to a range of behavioral and cognitive scripts for situations and problems. These new ideas, concepts, and scripts can then become inputs for the creative expansion processes with novel combinations (Weisberg, 1999).

Based on the above studies, we focus on those students who develop creative inventions in the exchange countries by thinking in ways they may never have in their home countries.

In this paper, we propose a framework for an exchange experience assessment (EEA) course (see Figure 2) based on our proposed enhanced intercultural transformation theory (EITT) (see Figure 1) to help students develop creative inventions during their academic exchanges. The framework comprises three phases (i.e., learner, explorer and inventor) and five EITT factors (i.e. stress, adaptation, growth, support and motivation) and how they interface with three stakeholders (i.e., student, patent advisors, and instructor). In the three-phase (learner-explorer-inventor) process, students have to attend briefing sessions, workshops, and seminars in their home country to learn the basics of patent knowledge (as learners); engage in cognitive, affective, and social exploration activities in their exchange countries (transforming into explorer); and create a utility design patent and business method patent (transforming into inventor) based on the requirements of the EEA course.



**Figure 2. EEA Framework**

Two seminars (i.e., “Introduction to Intellectual Properties” and “Industrial Design and Copyright”) enlightened the students to the world of inventions. A workshop provided students with experience in 3D printing technology to expose them to various invention methods. Also, we organized various course briefing sessions (i.e., “Discoveries and Innovations in Overseas Travelling” and “From Innovation to Commercialization”) to provide students with support and motivation to develop creative inventions during their academic exchanges.

We organized the course in such a way that the patent advisors and instructor would monitor students’ progress from time to time. The patent advisors would provide support (e.g., asking and answering questions about ideas of patent development) to students via email. The instructor would motivate students by providing them with the necessary resources to help them file their creative ideas for patent registration and setting the standard for course assessment. For more details of the course, please refer to the official university website (<http://www.cityu.edu.hk/ug/current/course/IS4935.htm>).

### 3.1 Stress

The three major theories on intercultural adjustment in the literature are social identification theory on cognition (Phinney, 1990), stress and coping model on behavior (Lazarus & Folkman, 1984) and cultural learning theory on affect (Furnham & Bochner, 1986). Though each theory has a different focus, all of them view cross-cultural contact as a dynamic process in which a sojourner seeks to develop stress-coping strategies and acquire cultural specific skills in order to effectively interact with the host cultural environment (Yang & Webster, 2011).

Specifically, social identification theory, including acculturation theory and social identity theory, focuses more on the changes in individuals' cognitive perspective on self and identity and on changes in how they perceive and relate with in-groups and out-groups in the adaptation process (Zhou, Jindal-Snape, Topping, & Todman, 2008). The stress and coping model deals with adjustment and the active process of managing stress for achieving psychological wellbeing. Finally, cultural learning theory underpins the necessity of performance skill for social interaction and learning of culture-specific skills as a response to the new environment that individuals face.

In our context, students face challenges in foreign countries so they can obtain a better education abroad, which will differentiate them from their peers upon returning home (Hegarty, 2014). However, once they land alone in a new environment with a different culture, they may have cultural shock and anxiety that result from losing all of their familiar signs and symbols of social intercourse (Oberg, 1960). Specifically, challenges emerge due to the language barrier, differences in food and customs, financial constraints, homesickness, loss of social status, fear, and a sense of insignificance (Hegarty, 2014). Therefore, students who decide to go abroad need to prepare themselves to leave their comfort zone.

Traditionally, students are accustomed to thinking in terms of what they receive from a course rather than what they contribute to the knowledge created in one (Leidner & Sirkka, 1995). Nevertheless, this course offers an opportunity for students to build up their knowledge repertoire at their own pace when trying to develop creative inventions under a stressful environment (e.g., facing a new culture) through adapting to a new culture during their academic exchanges.

### 3.2 Adaptation

People in the adaptation stage need enhanced skills to relate and communicate with people of other cultures. Adaptors may feel a powerful need to create a "holistic, coherent sense of self that somehow integrates multiple frames of reference" (Bennett & Bennett, 1993, p. 59). As Leung and Chiu (2010, p. 728) state: "The relationship between multicultural experience and creativity is particularly strong when people adapt and are open to these new experiences; multicultural experience does not improve an individual's performance in a creativity task unless the individual is predisposed to being open to experience" (Leung et al., 2008).

Leung and Chiu (2010) posit that exposure to multicultural experiences has positive effects on individuals' creative performance in generating unconventional gift ideas and acquiring the tendency to sample ideas from other cultures in a creative expansion task and with self-perceived creativity.

Prior research on nurturing creativity among undergraduates during overseas stays posits that the experience of cognitive dissonance results from the conflict between one's familiar cultural script and the foreign cultural script. It prompts complex cognitive and behavioral modifications in order to adapt a new set of cultural knowledge and traditions (Leung & Chiu, 2010; Tadmor, Tetlock, & Peng, 2009). Research has linked this adaptation process to cognitive complexity and flexibility associated with creative thinking, including the ability to recognize, generate, and synthesize seemingly unrelated cultural information in novel ways (Leung & Chiu, 2010; Leung et al., 2008; Tadmor & Tetlock, 2006; Tadmor et al., 2009). As such, we focus on the development of creative inventions by IS students while they adapt to a new environment during their academic exchanges.

### 3.3 Growth

Shi (2006) states that a person grows psychologically (i.e., they obtain a better understand of who they are, what they value, and where they might want to go) when socializing with other cultures by developing multiple lenses to view and make sense of their world. In doing so, they become more inclusive, less discriminating, and can better integrate cross-cultural perspectives. Along this vein, the EEA course helps

students grow into more skilled and knowledge individuals (from a learner to explorer and then to inventor).

Patenting always goes hand in hand with creativity. Some universities have implemented courses to teach students about patenting methods. Among very few studies, "Entrepreneurship in Computing" course (Hofstra University, USA) aims to make students understand the purpose, procedures, cost, and legal implications of patenting and related issues (e.g., licensing, infringement, trade mark, and copyright) (Kamberova, PAcelli, Impagliazzo, Currie, & Dobioli, 2011). It focuses on giving students some first-hand experience in these subjects and making them capable of judging the value and quality of patents, their costs and potential returns, and any associated pitfalls.

Another study presents a course that teaches undergraduate and graduate students (of Auburn University, Alabama, US) about protecting intellectual property rights. The course also trains them to prepare a patent application on their own inventions for submission to the U.S. Patent and Trademark Office (USPTO) as part of the learning process (Swamidass & Gokcek, 2010).

Our EEA course follows the same general idea, but students receive the teaching intervention during their academic exchange (instead of during an in-campus course). Thus, they become inventors through stress-adaptation-growth dynamics that Kim and Ruben (1988) posit while experiencing another culture.

When we began the course, instructor and patent advisors considered students' creating a patentable invention during their academic exchange a herculean task. However, due to the team's confidence, the EEA course emphasized the patentability of student creative inventions. As such, we needed specialized legal knowledge related to intellectual property to equip students to shape the patentable inventions. Thus, we hired two patent advisors for this course to support students to formulate and patent their creative inventions.

### 3.4 Support

We considered patent advisors to be appropriate support for students to formulate their creative inventions and turn them into patents. We recruited two patent advisors (one full time and another part-time who worked for 17 hours a week for three years) to communicate with students before, during, and after their academic exchange and help students according to their needs. The advisors provided students with feedback about their understanding of course material on patent knowledge by promoting the cognitive information processing model of learning (Leidner & Sirkka, 1995). Also, the patent advisors supported student inventions at any time and location via email (El-Shinnawy & Markus, 1992), which led to an ongoing invention process, time flexibility, and geographical independence (Leidner & Sirkka, 1995).

In EEA course, the patent advisors take three different roles: facilitator, consultant, and partner. As a facilitator, they need to help students to build up knowledge about innovation and to manage the online course, such as sending reminders on the deadlines for assignments and reports. As a consultant, they need to help students to know whether their inventions are patentable or not and guide them to prepare patent application once their inventions meet the patent requirements. As a partner, they need to help students to improve their inventions through face-to-face interactions to turn their creative inventions into patents after they return to the home country. Also, they need to provide students with visions for directions to explore and research on different knowledge domain and set the deadline by which they can realize these visions (Leidner & Sirkka, 1995).

### 3.5 Motivation

Yang and Webster (2011) suggest that students' goals for studying abroad, exchange country experiences, and learning outcomes relate to each other. Studying abroad has to be an active process of experiential intercultural learning in which students' goals motivate them to actively engage in experiences that are conducive to enhance their intercultural, disciplinary, and personal competencies (Yang & Webster, 2011). Some panelists at the 2011 Americas Conference on Information Systems (AMCIS) discussed the short-term, mid-term, and long-term challenges that various IS students teams faced when studying abroad.

In the EEA course, knowledge transfer office (KTO) personnel briefed students in their second year of study about patent knowledge through seminars to help them understand the intellectual property protection system and innovation methods. In cooperation with the university's education development and gateway education office, we conducted the workshop on 3D printing to sow the seed of creativity in



our students and provide them with the initial motivation to develop creative inventions during their academic exchanges.

In the EEA course, the course instructor entrusted students to submit an assignment on their invention along with the search report and other patent related reports. The instructor assessed these assignments based on the three patent elements (i.e., non-obviousness, novelty, and enablement). Also, the instructor assessed the blogs that the students submitted.

Student-centered learning involves learners' actively engaging in and managing their own learning (Lea, Stephenson, & Troy, 2003). As such, to determine our students' engagement and involvement during their exchanges, we created a blog to enable students to upload three of their social, cultural, and personal experiences in each semester and to raise feedback on each other's blogs.

Moreover, feedback from the instructor can empower individual students to regulate the aspects of their thinking and behavior during their academic exchanges. As such, we gave feedback to students about their understanding of goals, criteria, expected standards of good performance, development of self-assessment (reflection) in learning, and learning progress (Pintrich & Zusho, 2002). Also, we gave feedback to students to encourage their positive motivational beliefs and self-esteem and to provide opportunities for them to close the gap between their current and desired performance (Nicol & MacFarlane-Dick, 2005).

As a whole, the EEA course motivates students and leaves them with the responsibility to monitor their own learning progress during their academic exchanges. Students must know how to pace themselves, complete assignments on time, and meet the course's requirements. In the EEA course, the instructor has to instruct students and provide them with feedback effectively as Leidner and Sirkka (1995) note by asking the proper questions rather than guiding students toward the proper responses, by helping them share information to enable them to create knowledge, and by monitoring rather than leading the knowledge-creation process. Thus, in the EEA course, instruction and feedback moves away from disseminating knowledge toward creating knowledge. Also, we motivate our students by helping them to file their creative inventions through patent application in local Hong Kong patent office that can further enhance their career opportunities.

## 4 Evaluation Method

This paper focuses on IS students who went on two academic exchanges and attended our EEA course. The students had to create two inventions (i.e. utility design and business method). More specifically, this course had three main stakeholders.

1. **Students:** the third year IS students who went on exchange in two different countries, one in Asia (countries such as China, Singapore and Taiwan) and one outside Asia (countries such as USA, UK, and countries in Europe) for two different semesters. As a whole, the course had 27 students who were, on average 20 years' old. The students came from Hong Kong and from China, Korea, and Taiwan. Among these, 24 completed the course in one year. One student deferred one semester and two some semesters because of personal reasons. Also, all students were naive to innovation.
2. **Patent advisor:** patenting needs specialized legal knowledge in evaluating inventions. To have a robust course structure, we recruited one patent advisor to take care of day-to-day communications with the students and to scrutinize and give feedback on their innovative ideas during their exchange period. We recruited another patent advisor, an experienced patent attorney, to help students file student inventions in local patent offices.
3. **Instructor:** the professor who designed and implemented the course for the university strategic initiative of discovery enriched the curriculum. The instructor received the necessary funding to recruit patent advisors; organized briefings, workshops, and seminars; set up the blog website to record the student exchange experience; and provide necessary intervention when students needed so they could tackle the challenges they faced.

To assess the course's effectiveness, we collected data using interviews with unstructured questions on students' experience about their academic exchanges and creative inventions; the two patent advisors' experiences about their communication with the students; and the instructor's experiences in course design and implementation. Each interview lasted between 40 to 70 minutes for each stakeholder. We taped and transcribed all interviews. In addition to these formal interviews, we engaged in casual

conversation before and after meetings which we did not record for privacy reasons. We collected and analyzed all email communications between the three stakeholder groups during the entire academic exchange period. Additionally, blogs and assignment reports constituted a major data source for analysis.

Among the pile of interview materials, some important comments on the EEA course include:

*The workshops, seminars and briefings helped us to know about patent knowledge and the way to combine ideas that we explored during academic exchange for coming up with new inventions.* (Student)

*This program was an eye-opener. Especially when we imposed a requirement, it became a big challenge. When a student well through a challenge, they would learn and then improved.* (Patent advisor)

*The course was framed to give students an opportunity to think differently as they would have never thought in their home country. By applying the problem-solving approach, students were encouraged to discover problems in the host country and seek a solution that has patent potential.* (Instructor)

Appendix A shows some further comments. Table A1 also maps extracted comments from stakeholders with corresponding elements of the EEA course.

## 5 Evidence of Student Invention in EITT

In the EEA course, IS students filed 15 utility design patents (e.g., knitting holder, clotheshorse backpack, chopstick rack, plastic bag opening and holding device, strap, multi-functional desk, sphere conveyor, anti-spill cup, integrated postbox, hair dryer cap, and sink strainer). Also, they filed 16 business method patents (e.g., social product recommendation with augmented reality, smart bin, smart pay, menstural cycle predictor with online napkin shopping system, ordering system for boutiques, restaurant recommendation and review system, virtual reality shopping center, smart queueing machine system, 3D hairstyle design with 3D scanner). As general evidence of the EEA course's outcomes, Tables 1 and 2 summarize two student invention cases. We also map extracted email communication between the two students, patent advisors, and instructor with corresponding factors of our proposed enhanced intercultural transformation theory (EITT).

### 5.1 Case 1: Utility Design Patent

This invention is a knitting holder that allows people to easily carry relevant knitting equipment wherever they go.

**Table 1. EITT Factors Leading to Student Invention (Case 1)**

EITT factors	Extracted email communication between a student, patent advisors, and instructor and reports
Stress	"I found several important cultural and geographical features of Eastern or Middle Europe that affect peoples' behaviors. The most significant one is the short daytime during winter. They usually have sunsets around 4 pm. Also, it is rainy and gloomy from autumn to the end of the winter. This weather leads people to enjoy indoor activities such as cooking, baking or knitting. However, I figured out difficulties while carrying and holding knitting equipment." (Student 1)
Adaptation	"I tried to follow their lifestyle by staying close with my German friend in order to learn their culture..." (student 1) "I learnt knitting from the friend to stay indoors during winter time". (Student 1)
Support	"Good Job! In the next step, you should draft your final report based on the attached documents. During this process, you should improve your invention and try to avoid similarity. You also need to go deep into every detail of your invention, not simply describe it as an instruction book. You can draft it based on these existing patents, and learn how to use the wording to describe your invention." (Patent advisor)
Motivation	"Your patent invention must be a very good achievement in your resume, and may be an important consideration for me to mark your assignment, if you can obtain a patent as an inventor." (Instructor)
Growth	Knitting holder was developed for convenient knitting environment and filed as a utility design patent. (Application No 15102543.1) (Student 1)

## 5.2 Case 2: Business Method Patent

This invention is a platform that allows people to place their media on public displays at a fee.

**Table 2. EITT Factors Leading to Invention (Case 2)**

EITT factors	Extracted email communication between a student, patent advisors, and instructor and reports
Stress	<p>"It takes a lot of time to find a screen displaying train schedule." (Student 2)</p> <p>"I find that actually there are a lot of spaces that have been "wasted". The term "wasted" here means that some places, like airports and train stations, in which the spaces of those infrastructures are huge. It takes lot of time to find a screen displaying train schedule. I wonder, what if I put a projector that displays the real-time information on the wall. Would it be better for people to learn the information they need? (Student 2)</p> <p>I want to solve the problem of offline multimedia displaying problem in the digital marketing industry." (Student 2)</p>
Adaptation	<p>"During the exchange study at Peking University, unlike the situation in Hong Kong, in some sense, as the result of the population being more dispersing, I feel more comfortable " (Student 2)</p>
Support	<p>"But even if I spend the whole day to see if there is any similar patent, I found nothing. That's why I attached some patents that I think is irrelevant but somehow quite similar to my idea. See if you could help me to identify what kind of patents I should be looking for." (Student 2)</p> <p>"If you cannot find the similar patent, you should list these relevant patents/applications in the search report." (patent advisor)</p> <p>"I would like to advise you to draft a specification for applying for a patent. You can simply draft your specification by referring the template in the attachment. After you read the attachment, you will find it is very easy to draft your patent specification" (Patent advisor)</p>
Motivation	<p>"The successful application may grant you a greater competitiveness in job hunting, I therefore hope that you can complete the application as soon as possible." (Instructor)</p>
Growth	<p>Method and system for location-based multimedia advertising platform was designed and filed as a business method patent. (Application No 16102988.2) (Student 2)</p>

## 6 Discussion

Harris et al. (2011) mention that, during an exchange, students need to live in a new culture and interact with the locals in order to adapt to the new culture. As we report in the two cases in Section 5, students were motivated to explore issues of the stress that they faced in a new culture and create new ideas to adapt to the new culture by immersing themselves in it. Through students' interaction with the new culture, this adaptation process induced their creative thinking to create new product/service ideas with the support and motivation of their patent advisors and instructor. The summary of the two student invention cases (see Tables 1 and 2) confirms our proposed enhanced intercultural transformation theory (EITT).

The stakeholders' comments about the exchange experience assessment (EEA) course (see Appendix A) confirms the point that students, while adapting to the new culture, work on novel ideas to solve the problems and stress they faced during the exchange. Also, with the help of knowledge gained during the patent seminars, workshops, and briefings, they could find ideas during academic exchanges and then connect them to create a new invention. Also, the findings as illustrated by our proposed three-phased framework of EEA course and their interface with three stakeholders (i.e., students, patent advisors, and instructor) indicates that the three-phased process is aligned with all five EITT factors.

As we mention above, to ensure students could create patentable inventions during academic exchanges, they needed to attend briefings, workshops, and seminars on patent knowledge in their home country and engage in cognitive, affective, and social exploration to adapt to the stress that they encounter during their exchanges. Furthermore, when students receive appropriate motivation and support from patent advisors and instructors, they can take up the challenge to fulfill the course's goals by developing creative inventions, which leads to further growth. In this paper, we consider the three-phased EEA framework with five EITT factors as a creative and friendly environment to transform students from learners to explorer, and then to inventors during their academic exchanges.

## 6.1 Challenges in Implementing the Course

Of course, the EEA course involves challenges. For instance, students had challenges in facing the cultural shock and the adverse climatic conditions in various countries. In addition, students might be overloaded with other sources that they need to take in the exchange universities. Therefore, they need appropriate support and motivation from patent advisors and instructors.

Further, the patent advisors experienced challenges in replying to student mails because of the different time zones between countries. The patent advisors also experienced challenges in giving feedback to students because they usually started with obvious and unoriginal ideas. Helping undergraduate students develop solid patentable inventions really takes time and extreme patience.

The instructor experiences challenges in scaling up the EEA course and sought for more help from colleagues of the university. As such, implementing this EEA could be expensive (in particular, the cost of hiring patent advisors is not cheap). The instructor needs strong support from the university in terms of funding support and recognition.

## 6.2 Realizations, Limitations, and Future Directions

After interviewing students, we learned that most travelled to various countries and places during their semester holidays. Some even travelled to more than 10 countries in Europe. This active exposure to other cultures made them more open-minded when facing people with a different culture.

Students successfully filed some of their creative ideas for patents. Though not all student's ideas were patentable, most of the students successfully created novel ideas from their exchange experiences. One can attribute this partial success to students' not being technically competent in designing products and not having enough business knowledge to create innovative business method ideas. However, one student mentioned that it was a pleasant surprise to see his invention of a clotheshorse backpack (a backpack with an attachment to dry wet clothes) be considered as a patentable invention. The patent advisor commented that although this combination of some existing ideas was simple, it was considered as a patentable invention because no one had registered such an idea before.

Regardless, with appropriate support and motivation from patent advisors and the instructor, students successfully filed 31 out of 54 creative inventions of utility design or business method patents. To encourage the students, we presented those inventions to the university community during the Global Business Systems Management (GBSM) Business Innovation Exhibition in the form of posters with details of their engagement, problem identification, solution, design of the product/business method, contributions, and the patent advisors' comments. Appendix B shows a poster sample of a filed patent. Also, the university presented the best invention awards to students during the exhibition.

As Harris et al. (2011) note, institutional support (e.g., scholarships or other financial support) is another essential component for successful academic exchanges. Institutional recognition of the importance of academic exchanges in the internationalization process of its student bodies, faculty, and the institution itself plays a very important role of the EEA course. Extant research suggests that students learn effectively only if one intervenes before, during, and after their experiences abroad (Lederman, 2007). This paper provides evidence that supports these earlier studies.

Further, this paper has significant theoretical implications. Although many researchers have studied intercultural transformation theory (ITT) and identified many factors (i.e., stress, adaptation and growth) that lead to human attitudinal changes, few studies have examined students in the area of patent invention while on an academic exchange. This paper fills that gap and extends the ITT by adding two new factors (i.e., support and motivation). It provides some insight into the rarely visited issue of student's creativity during the stress-adaptation-growth process when they face a new culture. Our findings are consistent with the findings of many previous creativity studies on students exposed to other cultures (Leung et al., 2008). But the ITT model designed by Kim and Ruben (1988) is strengthened with additional factors of motivation and support that influences students' growth phase (i.e., patenting creative inventions) based on the stress and adaptation in the new cultural environment.

Our paper has practical implications in the area of student invention and academic exchange. This paper could help educators better understand the potential of students' ability in developing creative inventions when they undertake academic exchanges in new environments. Our proposed EITT model and EEA course can enable any interested faculty in any university to offer a similar course for the benefit of

budding student inventors in their campus through intercultural adaptation during academic exchanges. Also, this paper provides evidences of successful student inventions developed during their academic exchange, particularly in information systems (IS) discipline.

Although our findings are limited to IS students, we suggest that researchers may attempt to investigate similar behavior of students in other disciplines. A further quantitative study may help researchers understand more about the reality of “what” kind of stress that students face in different cultural environments and how stress aligns with students’ individual adaptation experiences and creative inventions when on academic exchange.

## 7 Conclusion

Researchers have scarcely examined the transformation of undergraduates into inventors during academic exchanges. This paper fills the research gap and proposes an extension of the intercultural transformation theory (i.e., enhanced intercultural transformation theory (EITT)) by adding two new factors (i.e., support and motivation) into the existing model. Based on the EITT, we propose an exchange experience assessment (EEA) course framework and examine the effectiveness of the EEA course on student inventions. Our findings suggest that IS students can develop patentable inventions through the stress-adaptation-growth process during their academic exchanges but that they need appropriate support and motivation. Our students filed 31 patents in the Hong Kong patent office. Also, this paper presents the EEA course structure from several angles including content, delivery, composition, student responses in the hope of enabling any interested faculty in any university to attempt offering a similar course for the benefit of budding undergraduate inventors during academic exchange.

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## Appendix A

**Table A3. Comments of Stakeholders on EEA Course**

Stakeholder/about	Students	Patent advisor	Instructor
Briefing, sharing, workshops and seminars	"The workshop and briefing helped us to know about patent knowledge and the way to combine ideas that we explored during academic exchange for coming up with new inventions."	"Briefing and workshops were organized to give students the basic skills needed to create inventions. We shared details of IP laws".	"Briefing and workshops were organized to give students the opportunity to prepare themselves to face new challenges in their life. Patent advisors with professional legal knowledge were recruited to prepare for these workshops and teaching materials."
Blog	"I did enjoy reading other students blog to know what others are doing"  "Motivated us to travel and visit places when we came to know about other students visiting different countries through blog entries"  "It is also a record for me because when I graduate and miss my happy times, it can just review it"	"Know how students are engaged when they are living outside."  "The blog platform rather than Facebook provided a chance for students to update their news and experiences in details, although they may not update and read these posts frequently. Blog was a good platform to let other fellows know what we are doing."	"Blog platform was created for students to record and share their exchange experiences, stimulate their creative thinking through online discussion among students, and motivate them to engage in the local culture, explore problems and generate creative solutions."
Idea creation	"Not that easy to get an idea"  "Worked on novel idea to solve the problem faced during the exchange."  "I would not get the idea if I was in Hong Kong."	"This program was an eye-opener. Especially when we imposed a requirement, it became a big challenge. When a student well through a challenge, they would learn and then improved."	"The course was framed to give students an opportunity to think differently as they would have never thought in their home country. By applying the problem-solving approach, students were encouraged to discover problems in the host country and seek a solution that has patent potential."
Guidance	"Advice whether the idea is appropriate or feasible"; "regarding the support, I got inspiration from their advice telling them how to do them, it can work."  "Patent advisor did give me a lot of suggestion during this process and one very interesting thing I found is that for I send an email to him, he will reply within 10 minutes."  "If I have a question, they give me an answer. I don't need to think about it."	"It was hard for me too to evaluate their ideas."  "Most of the time my work was to grant extension."	"We closely interacted with students and give them guidance on discovering and developing innovations with patentable potential that they encountered during their double exchanges."  "Patent advisors guided students to complete their inventions, and assisted them to file patent applications in local patent office."
Email	"Response from patent advisors was very fast"  "Got some harsh comments about my idea."  "Could improve the idea based on the advices given."	"Send mails about submission deadlines and evaluate the presented ideas and tell them how to improve their ideas via innovation methods."	"I acted as linking bridge between students and patent advisor when students are staying in places all over the world."

**Table A3. Comments of Stakeholders on EEA Course**

Assignment	<p>“Was beyond my capability”</p> <p>“I think assigned task help me a lot because it can give us a goal which we want to achieve.”</p>	<p>“For the assignments regarding inventions, we tell them how to build up their own inventions by completing idea report, search report, comparison report and final report in the form of patent specification.”</p>	<p>“Blog assignment was given to students to record and share their exchange life on the blog platform.”</p> <p>“Students need to submit complete report on individual project regarding utility invention in the first exchange; complete report on individual project regarding to business method invention in the second exchange.”</p>
EEA Course	<p>“I became out-going and could take risk due to this course.”</p> <p>“This opened up my mind to different possible solutions for different problems, it trained me to be more creative.”</p> <p>“Innovation and creativity were far for me. Though my idea is innovative or creative, but the focus is we are trying to be innovative or creative.”</p> <p>“It is difficult but worth it.”</p>	<p>“Someone who engage more will actually explore more issues. They would know more because they are more engaged into the local culture. You know, they are actually exposing to new things, and appreciating different ways of doing things. So I think it is very logical that when students are more engaged in the local activities, they actually get more creative ideas.”</p>	<p>“Opportunity to provide students with an appreciation for cultural difference, and motivate students to explore global problems and solutions during their exchange studies; to promote our student’s ability to discover, to find out the elements that is necessary for students to explore new ideas.”</p>
Monitoring	<p>“The monitoring was very efficient with immediate replies from patent advisor”.</p>	<p>“Blog platform provided a chance to learn about students’ situation and give them some help immediately. We could monitor and supervise the process of innovation.”</p>	<p>“Emails worked out to be a good option to contact students stationed in various corners of the world.”</p>

## Appendix B

Organizer



香港城市大學  
City University of Hong Kong

Innovation Commons




### GBSM Business Innovation Exhibition & Award Presentation 2016

# Location-based Multimedia Advertising Platform



## Elton Yan Ting LAU



Winner

HK Short-term Patent Application No. 16102988.2

#### DISCOVERY

**Exchange Engagement:**  
During the exchange study at Peking University, I found the situation very different from Hong Kong. In some sense, it is the result of the population being more dispersing, I feel more comfortable.

**Identified Problem:**  
While being more comfortable, at the same time, I also found that there are a lot of spaces that have been "wasted". The term "wasted" here refers to those places such as airports and train stations which the scale of their infrastructures are huge. I have to take a lot of time to find a screen displaying train schedule. I wonder, what if I put a projector that displays the real-time information on the wall? Would it be better for people to know the information they need?

**Proposed Solution:**  
I want to solve the problem of multimedia displaying information send to and from users in the digital marketing industry.

**Diagram:**



#### INNOVATION

**Description:**  
The current invention aims to display multimedia on the surface of a wall, a floor or a screen at different location, date and time which are connected to a server and to the internet, that is, they are online, not offline.

The platform comprises a website accessible online to upload video audio files through the internet into multimedia distributor and to order advertisements playback at different projectors/LED screens at different location, time and duration using a map.

**Contribution:**

- SMEs become easier to make online multimedia marketing campaigns;
- The public can benefit from fully utilizing the space of different public buildings and obtain useful information;
- Space owners can generate incomes by using the "wasted" space.
- Transforming the traditional advertising industry from wholesale model to retail model.

**Advisor's Comment:**  
This is a good demonstration of a Business Method Patent. A new idea of doing business that is not being done before. This invention allows regular people to place their media on public displays at a fee. Imagine you can put out a message "I love you" on Mother's day on the big TV screen at Times Square, and take your mom there to see it.

Co-organizers






Figure B1. A Poster Sample of the Filed Patent

Volume 40

Paper 19

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