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Evaluation of a Cross-Cultural, Cross-Faculty Course – iMDE international Market-Driven
Engineering Using Traditional Course Evaluation and PERTEX

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Evaluation of a cross-cultural, cross-faculty course - iMDE international Market Driven Engineering using traditional course evaluation and Pertex.

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Abstract:

The iMDE course was given the first time during the fall 2012 at Zhejiang University with 20 engineering students and 20 business students from the technology management program in Lund, Sweden and about 15 Chinese engineering students and 15 Chinese business students. During the course the students worked in 8 student groups of about 8 students fully mixed between faculty, country and gender. The task of each group was to invent, design and prototype a product to "help everyday life", each group also made a business plan, a marketing movie and a group-development movie.

In order to evaluate the students' learning from the course a short standard course evaluation was carried out alongside a Pertex analysis.

For the Pertex analysis the students were asked after the course to produce a text about the course in accordance with the Pertex methodology. The texts of the respondents have been run through a Pertex analysis. The empirical setup consists of 3 dimensions each with 2 groups: Swedes-Chinese, engineering-business, male-female.

The Pertex methodology is briefly described and the Pertex analyzed texts are discussed and compared to the result of the traditional course evaluation.

The results show that:

1. The outcome of the Pertex analysis supports and deepens outcome of the traditional evaluation and the information revealed by the Pertex analysis is not obtainable via traditional evaluation.
2. The Pertex analysis reveals that the different groups of students[1] perceived the course partly alike and partly different.
3. The students take-away from the course seems to differ most in the dimensions in the following order, arranged from most to least:
   a. Attitude: (Positive – Negative).
   b. Home University: (Swedish –Chinese)
   c. Major: (Engineering – Business)
   d. Gender: (Male – Female)

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[1] Nine Groups of students: Swedes-Chinese, engineering-business, male-female. One of these eight groups is split into two subgroups making a total of nine groups of students of the Pertex analysis. Not to be confused with the eight mixed student groups working with one project each in the course.

1. Introduction

"The world is becoming more international and cutting edge knowledge in marketing as well as engineering in a global world is becoming a valuable asset on the job-market." This text is taken from the home page of iMDE (international Market Driven Engineering)[2]. The course introduction text continues: There is a lack of people with skills in both fields with the ability to connect market needs and innovations with product development, especially in an international context. International Market Driven Engineering (iMDE) is aimed at providing these knowledge and skills. In essence the course goal is to educate and train students in entrepreneurship (Nilsson, C-H et. al., 2012).

The course International Market-Driven Engineering is a joint course collaboration between Technology Management at Lund University in Sweden (LU), and three schools at Zhejiang University in China (ZJU). The course is developed within the framework of LU-ZJU JCIE (Joint Centre for Innovation and Entrepreneurship). The course aims at making it possible to intertwine the two disciplines Technology and Management, in Sweden and in China, in four ways; Students, Teachers, Subjects and Cultures.

The 69 students taking part in the course were split into 8 mixed student groups, each consisting of a mix of:

- Swedish and Chinese students.
- Engineering and Business students.
- Men and women.

The groups are responsible for running a project of their own within a common theme for all 8 student groups: - "helping-everyday-life". The theme is open allowing ample room for each of the student groups to define a specific topic for their group. The deliverables from the student groups are:

- A market-and-business-plan for their product.
- A prototype of their product.
- A marketing film for their product.
- Documentation of the group-process (by filming) their work along the way.
- An oral presentation of their market-and-business plan.
- A written report containing a market and business plan.

The groups are encouraged to contact companies for support of the project and possible commercialization, although it is not a prerequisite for the course and not part of the grading. Each group has a budget of maximum 1000 Yuan. The 8 student groups worked on distinctly different products although the all fall within the common theme: "helping-everyday-life"[3]. The course content is a mix of topics needed for the project deliverables and covers the following theoretical and practical areas:

- Innovation – Inspiration, Ideation, Implementation
- Product development – Sourcing and Production
- Business Plan
- Marketing and Sales

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[2] http://www.control.lth.se/Education/EngineeringProgram/TMAF05.html, 130701
[3] https://www.researchgate.net/publication/248708013_iMDE12_AllPrototypes, 130715

In addition Chinese culture classes are given for the Swedish students[4]:

- Survival Chinese
- Calligraphy and painting
- Chinese character in writing
- Visit to museum
- Company visit
- Chinese History
- Chinese customer behavior
- Traditional healthcare and medicine
- Chinese art and paper cutting

The Course was held the first time in the fall of 2012. This paper evaluates the course with two tools, traditional evaluation via a course development form in which all students were asked what parts of the course they would like to: remove, improve or add. The same students were then asked to fill out a form designed to capture the thoughts on taking part in the course with the help of Pertex analysis that will later be described.

1.1 Purpose

The purpose of this paper is to evaluate the course and the students' learning from the course using both a short standard course-evaluation scheme and Pertex analysis. The findings of the short standard course evaluation are compared to the findings of the Pertex analysis.

2. iMDE – the course

The course[5] is a joint course with Zheijang University in Hangzhou, China. It intertwines the two disciplines Technology and Management, in Sweden and in China, in four ways; Students, Teachers, Subjects and Cultures.

Subject: the focus will be on Innovation and Product Development, a subject that is of great relevance from both the technical aspect as well as the economical and management aspect. The course will contain both lectures and a project. For the Swedish students the course will also contain a few lectures on Chinese culture. At the end of the course the students should present their project through a written project report and an oral presentation.

Students: The course is given to the 40 Swedish students from the Technology Management Program at Lund University (20 from LUSEM[6] and 20 from LTH[7]) (Nilsson, 1997; Johansson and Nilsson, 2008) together with, a minimum of 20 Chinese students (10 from SoM[8] and 10 from the technical departments (ID[9] and CSE[10])). In the first year 29 Chinese students were enrolled in the course.

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[4] Partly due to differences in the number of academic credits for the Chinese and Swedish students which in turn is due to administrative differences between the universities.

[5] https://www.researchgate.net/publication/248708100_Course_ProgramTMAF05-ht2012, 130715

[6] School of Economics and Management, http://www.lusem.lu.se, 130715

[7] Institute of Technology, http://www.lth.se//english, 130715

[8] School of Management, http://www.som.zju.edu.cn/en/, 130715

Teachers: Teachers from both Sweden and China and from both Engineering (LTH, ID and CSE) and Management (LUSEM and SoM) will be involved in the lectures. A minimum of two teachers with different aspects of the subject matter will be present at each lecture.

Cultures: The cultural aspects of project management and business behavior will be treated in the course and practiced in real life through the course project.

3. Course Development Form

Most all courses at Lund Institute of Technology are evaluated in a standard format CEQ[11] Course Evaluation Questionnaire. The amalgamation of the CEQ-evaluation from the Swedish iMDE students has been delayed and will hence not be taken into account in this paper. Instead a course development survey that was completed by the students is used to make a comparison with the Pertex analysis.

In order to chart the students' suggestion on improvements a course development survey was conducted among all course participants. About 50% of the participants provided input for the conclusions based on the Course Development Form. The complete results of the survey[12] are amalgamated in Figure 1 and Figure 2.

The course can be delivered in three ways, 100% in China, 100% in Sweden or 50/50. In total there is a weak preference for studying the full course in China whereas the Swedish students prefer to study in China while the Chines student prefer 50/50.

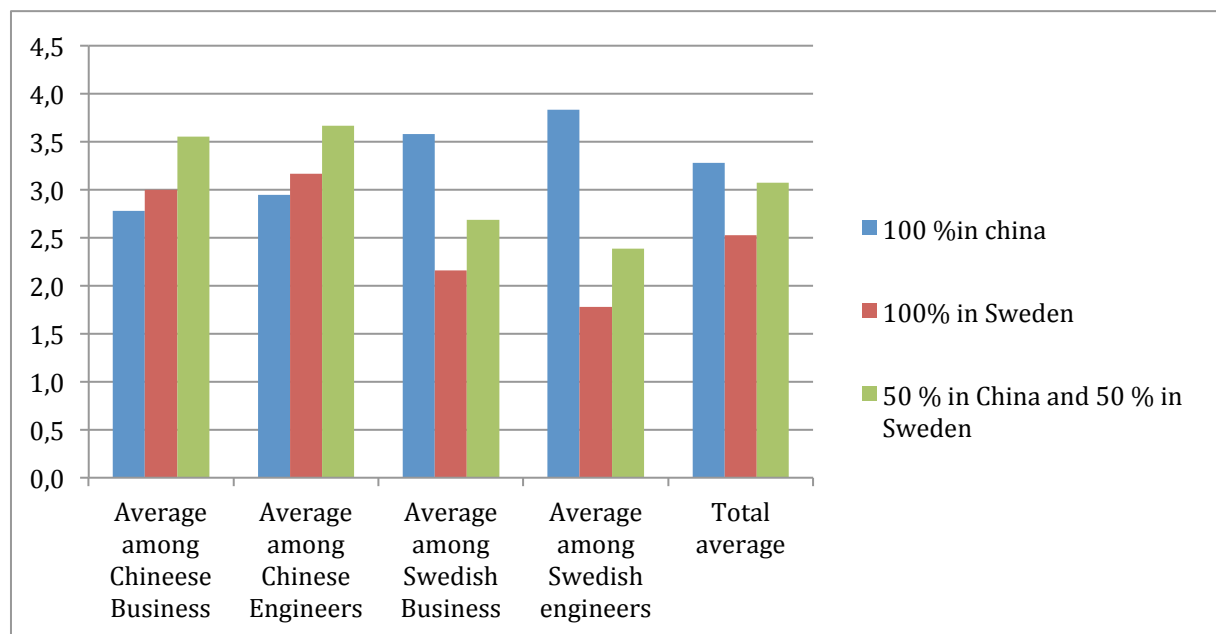Figure 1. The different Student groups' preferred localization of the course.

[9] Institution of Industrial Design http://www.cs.zju.edu.cn/english/redir.php?catalog_id=22995, 130715

[10] Department of Control Science and Engineering http://www.cse.zju.edu.cn/english/, 130705

[11] (http://www.ceq.lth.se), 130715

[12] https://www.researchgate.net/publication/248708200_iMDE12_evaluation_-_students, 130715

Furthermore the same groups of students were asked to elaborate on what to: remove, improve or add to the course curriculum. This way of asking open questions leaves ample room for individually chosen feedback on many issues related to the course.

	Chinese Business	Chinese Engineers	Swedish Business	Swedish Engineers
Remove	Nothing, all parts are necessary	Nothing! Company visits (or improve)	Some teachers First company visit Content similar to prior courses	Some teachers' content Content similar to prior courses
Improve	Company visits Interaction between the 8 student groups Business plan	Administrative systems (registration) More coaching time Consumer behavior	Lectures first 2 weeks then project coaching Business plan lecture	Company visits Coaching sessions Market and business planning
Add	Swedish culture class Learning between the 8 student groups	How to manage teams More activities between the 8 student groups.	Welcome party More activities between the 8 student groups. Teamwork and Leadership	Integration activities Swedes-Chinese people Team work and Leadership

Figure 2. Summary of findings from the course development form.

4. PERTEX

The Pertex Analysis[13] (Helmersson, 2010) can best be described as intuitive text-analysis. Traditional text analyses are founded on text writers that freely formulate their text from their experience, point of view and in tune with their own frame of reference. The text reader interprets the author's text and the interpretation is colored by the reader's experience, point of view and frame of reference. The readers' ambition with reading the text as well as their purpose in reading the text can and will often influence the interpretation, hence the writers objective may be repressed by the reader's frame of reference, ambition and purpose and the text analyses of two readers may well differ substantially from each other and form the objective of the text writer. (Helmersson, 1992)

Pertex on the other hand gives the text writer the right to prevail by using the text writer's own frame of reference as found embedded in the text. Pertex uses three fundamental human functions: objective, action and orientation. These are axiomatic starting points for our existence. If you as a mental experiment try to eliminate any one of them your existence will become meaningless from a human perspective. A physical parable is Force (Newton) that has origin, magnitude and direction. Take one away and you loose physical meaning of a specific Force.

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[13] For an extensive description of Pertex and the theoretical foundation of Pertex: https://sites.google.com/site/aaoaxiom/pta-pertex

A text writer writing a meaningful text on a defined theme does so based on current objective, action potential and orientation, which will make "footprints" in the text. Pertex is deciphering these footprints using the text writer's objective, action and orientation rather than the readers. A more detailed explanation of Pertex is found in appendix 1.

With this instruction each student is free to elaborate on his or her experience of taking part in the course. The Pertex text-analysis allows us to chart the different student groups' experiences from taking part in the course.

Text analysis - international Market Driven Engineering
Please fill in:
- Chinese/Swedish:
- Engineering/Business:
- Male/Female:

> What is your experience of being involved in a project on Innovation, Prototype and Business plan, in combination with Technology and Management in a mixed cultural context.

Writing style: e-mail to an old friend. (about 1/3 page):

Figure 3. Instruction to the respondents for writing the Pertex text.

5. Pertex Analysis

The Pertex analysis was conducted on all students of the course. The empirical material was then primarily categorized in three dimensions:

- Home University (Swedish –Chinese)
- Major (Engineering – Business)
- Gender (Male – Female)

Based on two distinct subsets of texts in the category Swedish, Engineering, Female, this material was further sub-divided in two sub-categories of Attitude (Positive – Negative) providing the following total sample:

Home University	Major	Gender	Attitude		Comments
Swedish	Engineering	Female	Positive	5	
			Negative	2	
		Male		4	
	Business	Female		3	
		Male		4	
Chinese	Engineering	Female		5	Sample text in Fig. 5
		Male		8	
	Business	Female		2	
		Male		3	
Total				36	

Figure 4. Respondent distribution in the Pertex analysis.

The text in figure 5 is a sample text from one of the Female Chinese Engineering students. The text from all five Female Chinese Engineering students are then amalgamated and the Pertex analysis is using all text from the five persons in this group to synthesize into the cluster tree in Figure 6.

"Dear friend,

I just had a busy and full time. In the past 30 days, I joined a course which is called iMDE. We were separated into 8 groups, and each group was consisted of Swedish and Chinese students. We had to make a prototype, write a business plan and a final presentation. I think we had a very successful presentation yesterday. In our group, there're five interesting Swedish. I'm very glad I could meet them. We had a very nice cooperation, although we have many differences and barriers. In this course, I learned how to arrange entertainment and work time effectively from Swedish people. They were always full of energy which infected me a lot. In our project, I found the most difficulty is how to do a good need finding then find a meaningful solution.

This course gave me a lot of things. Firstly is friendship, I met a lot of Swedish friends. They are all very friendly and enthusiasm, we had some dinners and activities together. We all enjoyed it, and one of my Swedish friend invented me to her wedding in the coming future. And I believe we can meet somewhere in future. I love Swedish people! Secondly is culture difference. We come from different country, different living environment. There are a lot of difference, including how we thinking and doing things. Thirdly is that I knew and experienced how is foreign course coming. I think this real experience is very useful for my future choice about whether plan to study abroad.

That's my meaningful month just passed. I will miss my Swedish friends.

Best regard,

XX"

Figure 5. Text sample from one of the Female Chinese Engineering students.

5.1 Pertex Analysis of Chinese and Swedish groups.

The pretext analysis exposes text writers' frame of reference as found embedded in their texts and reveals the embedded meaning of the text writers' freely written text. The meaning embedded in the text is presented in the form of a cluster tree building up the line of thought from its beginning to is condensed concluding summary statement.

The following Pertex cluster tree is the Orientation synthesis of the full texts of the five Female Chinese Engineering students. Orientation is the first of five cluster trees for each of the student groups analyzed with Pertex.

The denominations for clusters visually show us how the text writers' pattern of thought evolves. The essence of the full text is captured in the root (bottom) of the cluster tree with one single concept or expression. The cluster tree is read from top to bottom and from left to right.

```
1
┌─────────────┐
│Joint project:│
│Tech./Managem.,│
│Sweden/China  │
└─────────────┘

2
┌─────────────┬─────────────┐
│Marketing the│Focus on     │
│product      │▶Market       │
│             │management   │
└─────────────┴─────────────┘

3
┌─────────────┐
│Personal     │
│experience   │
│             │
└─────────────┘

4
┌─────────────┬─────────────┬─────────────┐
│Improved     │Personal     │Learning about│
│ability      │▶learning     │▶market       │
│             │             │management   │
└─────────────┴─────────────┴─────────────┘

5
┌─────────────┬─────────────┐
│Different    │Marketing was│
│aspects in the│▶important in │
│course program│the program  │
└─────────────┴─────────────┘

6
┌─────────────┬─────────────┐
│Useful product│Development for│
│development by│▶the market by│
│nice friends │nice friends │
└─────────────┴─────────────┘

7
┌─────────────┬─────────────┐
│Student groups│Development by│
│in iMDE      │▶team work in │
│             │groups       │
└─────────────┴─────────────┘

8
┌─────────────┬─────────────┐
│Differences, │Successful   │
│but successful│▶development by│
│cooperation  │team work    │
└─────────────┴─────────────┘

9
┌─────────────┬─────────────┐
│Harmonious   │Harmonious   │
│work though  │▶team though  │
│differences  │differences  │
└─────────────┴─────────────┘
```
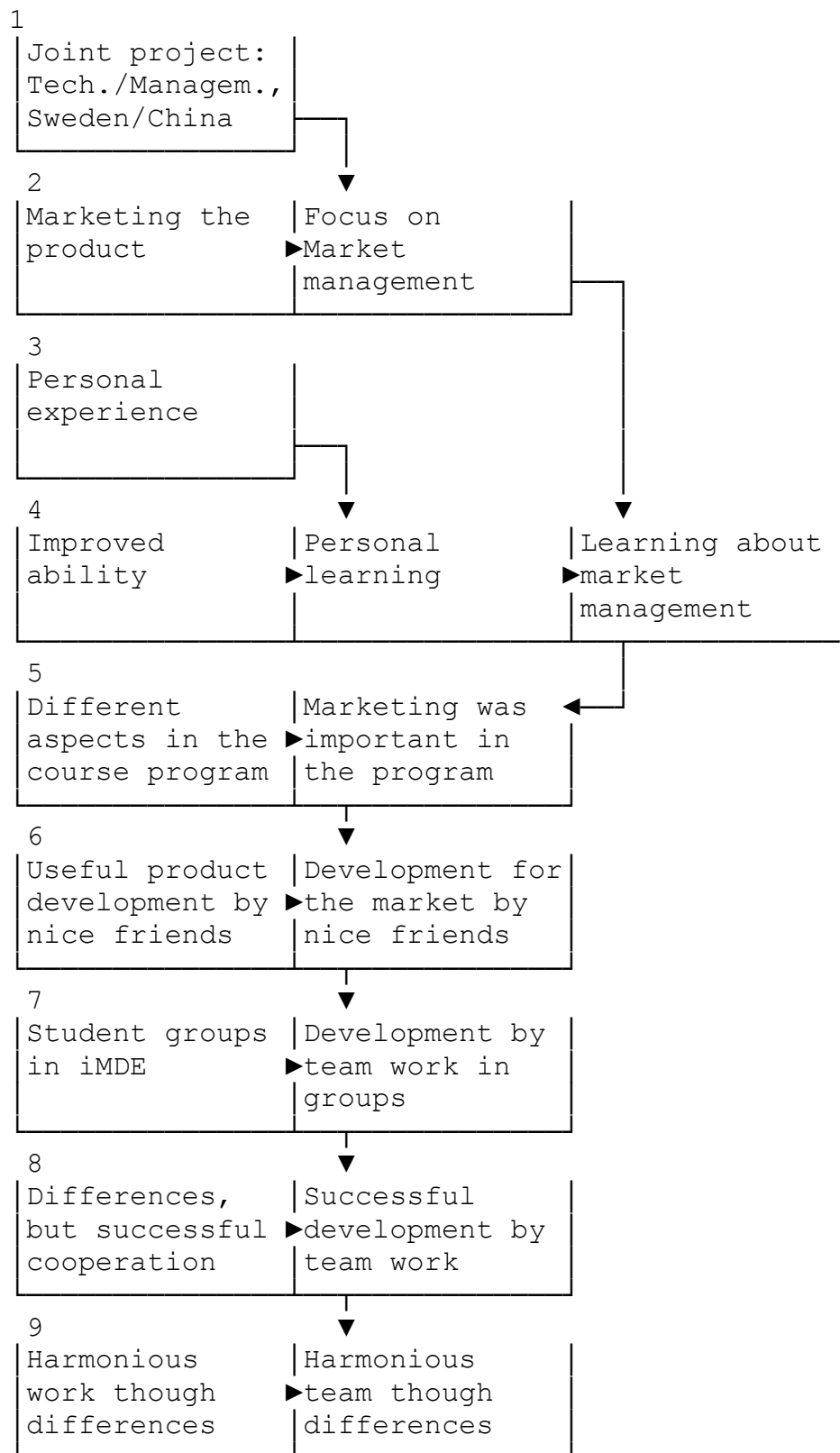
Figure 6. Chinese, Engineers, Female (n=5), 9 clusters for ORIENTATION.

In the same manner at the next more detailed level of Pertex the text's Orientation is nuanced in four fractions: Figure (Gestalt), Ground, Means and Goal. The Figure (Gestalt) represents the evolving picture in the text or the gestalt of the matter in focus. The Ground

represents the prerequisites for the picture (the gestalt) that is described. The Means represent which instruments are used to do something (perform an action) and the Goal represents the persons target for the actions. The groups of students (2*2*2 matrix of Swedes-Chinese, engineering-business, male-female are synthesized in Orientation, Figure, Ground, Means and Goal.

In one of the groups, Chinese Business Female only two respondents answered and the texts did not provide information on means and goals. In an other group: Swedish Engineering Female the respondents were split into two distinct subgroup since the collective texts were not possible to synthesize into one coherent text. By splitting the respondents into one negative group and one positive group the two groups were synthesizable and we therefore have nine groups of students that are analyzed with Pertex, five Swedish groups and four Chinese groups.

Chinese Engineers, Female (n=5)
Orientation	Harmonious team though differences
Figure	Harmonious team though differences
Ground	Harmonious integration at group level
Means	Co-operation on course theme
Goal	The course as a step towards the future

Chinese Engineers. Male (n=8)
Orientation	Positive course with international cultural context
Figure	Positive course with international cultural context
Ground	Learning by teamwork in a real project
Means	Teamwork with different fields and cultures
Goal	Personal learning from Swedish influence

Chinese Business, Female (n=2)
Orientation	Mixed cultural development of course project
Figure	Mixed cultural development of course project
Ground	Cultural impressions in course project
Means	--
Goal	--

Chinese Business, Male (n=3)
Orientation	Only positive to work with international friends
Figure	Only positive to work with international friends
Ground	Harmonious thinking in mixed context
Means	Swedish influence in the group
Goal	Opportunity for personal experience

Figure 7. Final concepts from Chinese groups[14].

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[14] A full description of the Orientation cluster trees for all of the four Chinese groups.
https://www.researchgate.net/publication/248708327_Pertex_synthesis_Chinese_students

Swedish Engineers, Female, Positive (n=5)

Orientation	The project is important in CV in the future
Figure	The project is important in CV in the future
Ground	Experience from the capacity in Chinese culture
Means	Mix of Swedish and Chinese students
Goal	A project with lifelong effects

Swedish Engineers, Female, Negative (n=2)

Orientation	Project failure for the Swede
Figure	An unsuccessful project
Ground	No cultural integration in the project
Means	Missing involvement in the project
Goal	--

Swedish Engineers, Male (n=4)

Orientation	New personal insight and development
Figure	New personal insight and development
Ground	Teamwork in intercultural context
Means	Positive attitude to the project
Goal	A six week challenge in China

Swedish Business, Female (n=3)

Orientation	Insight into China, perspective on Sweden
Figure	Insight into China, perspective on Sweden
Ground	Cooperation in mixed cultural context
Means	Positive working climate
Goal	Focused problem solving in the course

Swedish Business, Male (n=4)

Orientation	Integration and cooperation in the group
Figure	Integration of the project conditions
Ground	Innovation based on sense of community
Means	Technology students are important for the result
Goal	Innovation as own experience for the future

Figure 8. Final concepts from Swedish groups[15].

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[15] A full description of the Orientation cluster trees for all of the five Swedish groups. https://www.researchgate.net/publication/248708325_Pertex_Synthesis_Swedish_students, 130715

6. Conclusion

The amalgamation of the Course Development Form reveals similar views on the course from the full student group. Overall the students are satisfied with the course and the course content. Only minor flaws taint the overall positive or very positive evaluation. As can be expected minor differences stand out, for instance the Swedish students that find the course content to overlap prior course content to a higher degree than the Chinese students do. Some of the lectures do not fully meet the expectations of any of the student groups which is also the case for the company visit, which is the primary suggestion for improvement. All groups of students enjoy and value the cultural interaction and group dynamics which is the back-bone of the course. Furthermore on the issue of adding components to the course matters of social interaction stand out as the single most wanted addition to the current curriculum wanted by students from all of the student groups.

- Increased interaction among the 8 student groups.
- Integration activities between Swedes and Chinese People, for instance a welcome party.
- Classes on how to manage teams (project management).
- Classes on how to work in teams (teamwork).
- Classes on pure Leadership matters (Leadership).

Since the Course Development Form and the Pertex analysis have different scopes and are aiming at different goals the result will of course differ. The conclusions from the Pertex analysis summarized in the cluster trees and in the final concepts from each of the nine groups of students reveal a more nuanced picture of the meaning and utility of the course.

The means of the course for all, except the Negative Swedish Female Engineers, is cooperation, teamwork, mixing of cultural backgrounds and educational background. The Negative group describes unsuccessful projects based on no cultural integration and missing involvement in the project.

The goals of the eight Positive groups of students revolves around the course providing a step towards the future with lifelong effects and personal learning and development based on working in groups with different cultural and educational background. The Swedish business students, both Male and Female stand out in terms of their Goals, those revolve around focused problem solving in the course for the Females and Innovation as own experience for the future for the Males.

A cross-fertilization of the conclusions of the Course Development Form and the Pertex analysis reveals that all groups of students, with the exception of the Negative Swedish Female Engineers, revolve around concepts such as harmonious teams, mixed cultures, co-operation, teamwork, personal insights and development much in line with the findings from the Course Development Form.

In the final analysis we have four dimensions: Positive and negative attitude, Swedes-Chinese, engineering-business, male-female. The result of the Pertex analysis and thus the take-away from the course seems to differ most in the dimensions in the following order, arranged from most to least:

1. Attitude: (Positive – Negative).

2. Home University: (Swedish –Chinese)
3. Major: (Engineering – Business)
4. Gender: (Male – Female)

More research is needed to further dig into the Pros and Cons of mixed groups of students. For instance:

- Is it an advantage or a disadvantage to have both positive and negative students?
- Is it an advantage to add a third or more groups of students with other cultural backgrounds, from Universities in other parts of the world? Or will the possible added need of integrative course elements consume the advantage of a higher mix?
- Is it an advantage to add groups of students with different academic background, such as Law students or Psychology students or would the possible advantages be similarly consumed?

The Overall result of this research is that the advantages of mixing groups of students in many dimensions for academic work involving Innovation, business planning and marketing is overwhelming and is hence strongly recommended.

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Appendix 1 – Pertex in more details

The identification of objective, action and orientation in a text is done based on the following, called the Aa0 Axiom Agent – action – Objective:

- Action is manifested by a verb
- Orientation is indicated by the word before the verb (denominated Agent in Pertex)
- Objective is manifested in the design of the text in which the Verb and the Agent is embedded.

Sometimes this is caught within one sentence, sometimes not. Traditional grammar or text constituent analysis does not provide additional meaning to a Pertex analysis, instead it may blur the Pertex picture.

Pertex is performed in a well defined procedure consisting of a number of steps for the full text to be analyzed. The basic steps are:

1. Agent, action (verb) and Objective are identified in a text block, centered around a verb.
2. The unique sets of Agents and Objectives are identified and arranged in a binary (0/1) matrix with a unique Agent per column and a unique Orientation per row. 1 in a square indicates the existence of that combination of Agent and Objective.
3. A hierarchical cluster analysis is performed on the matrix. The Orientation formulations are clustered around the Agents as controlling variables, resulting in a unique cluster tree for each text.
4. The Pertex user then creates a suitable notion for each cluster. It is thus the agents that control merged texts for each cluster. This procedure provides a least common denominator among the Orientation words that belong to each cluster.
5. The last step is to fuse the conceptual notions along the orientation clusters to the root and the final cluster, which is the concentrated characterization of the full text.

At the next more detailed level of Pertex the text's Orientation can be nuanced in four fractions: Figure (Gestalt), Ground, Means and Goal. The Figure (Gestalt) represents the evolving picture in the text or the gestalt of the matter in focus. The Ground represents the prerequisites for the picture (the gestalt) that is described. The Means represent which instruments are used to do something (perform an action) and the Goal represents the persons target for the actions.

Pertex provides insight for non-trivial texts. For trivial text such as "I love you" Pertex will not provide any added insights, however if the text writer elaborates on the theme the connections between agents and Orientation will provide a pattern that will clarify how love is manifested in relation to "You" in the mind of the text writer.