Activity-based Learning Experiences in Quantitative Research

Methodology for (Time-Constrained) Young Scholars -

Course Design and Effectiveness

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POMS 20th Annual Conference,

Orlando, Florida, U.S.A.,

May 1 to May 4, 2009
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The paper investigates the reaction of PhD students and junior faculty to a six-month course in Survey Research Methodology (in particular, supply chain management and entrepreneurship) that used active learning experiences. Noteworthy is that the course was tailored to an audience with variable previous knowledge, interests, available time, cultural background, research and writing skills. Thus, a major challenge was presenting an intimidating quantitative course while bridging variation in learner backgrounds. Here we present the course design and its effectiveness. Empirical evidence indicates that an active learning approach is more successful than the traditional technique-based course and exam format. We analyzed learning preferences, overall knowledge and skills acquired, and degree of satisfaction - before, during, and after the course. Although the efforts of tailoring the course to a heterogeneous group are substantial, the benefits outweighed this. Each participant was not only engaged in complicated statistical methods, but also developed lifelong empirical research skills.
1 Introduction

Activity-based learning (ABL) is a successful teaching model in the field of medicine, engineering and science, and it has recently found its way to business schools. At its core, this approach provides a way to integrate learning within students’ knowledge, and, by exposing them to a variety of activities, helps them learn how to learn. Due to the high degree of interaction in ABL, essential instructor skills involve facilitating, motivating, enabling and coaching rather than simply presenting facts and figures didactically.

In this paper, we describe how we implemented ABL experiences in a newly-developed Advanced Quantitative Research course targeting Chinese PhD students and junior faculty. In order to enable participants to see its relevance, we selected ABL for two principal reasons: first, doctoral students are naturally involved in investigating, discovering, and interpreting; secondly, we focused on operations management problems because China has become virtually the world’s factory. To our knowledge, this is the first course in this field at a university in China entirely taught by a scientist without Chinese heritage.

Implementing an “innovative” teaching approach is only successful when the specific infrastructure and student situation are considered. Thus, a modified teaching ‘strategy’ must be carefully developed. Given this context, the article describes:

1. the key principles for the ABL teaching approach,

2. chief activities nurturing and fostering ABL experiences, and

3. how ABL impacts the effectiveness of the course.
2 Activity-based Learning

In a ‘traditional’ class there is a perception that the most industrious students are those who passively soak up everything the teacher might serve up to them in a suitably ‘didactic sauce’ only to ‘spout it’ back word-for-word. It was important, therefore, at the beginning of the course, in the introductory lecture, to stress that participants do not need to repeat things learned word-for-word. Rather we expressed our vision that students evolve into “investigators”, starting an independent inquiry into a topic of interest in a self-directed manner. Consequently, facilitating, motivating, enabling and coaching are the key skill-set of the instructor (facilitator) rather than just didactic lectures. At the beginning of the class, we illustrated ABL with a famous saying of Confucius that stresses participation as the key to students’ learning success (see Figure 1):

“Tell me, and I will forget,
听到，我会忘记，
Show me, and I may remember,
看到，我会记住，
Involve me, and I will understand.”
参与，我会明白。

Figure 1: Teaching Style as outlined by Confucius

There are numerous individual learning theories attempting to find answers to the problems of helping students learn and adapt to new situations; two stand out: behaviorist theory (B.F. Skinner) and cognitive theory (Jean Piaget). Behaviorist theory states that knowledge exists independently and outside of people, i.e. only small bits of information are transferred to learners, with learning success achieved only when a connection is established between a stimulus and a response (credited to the work of B.F. Skinner). The second theory,
cognitive theory, stresses the importance that learning is a result of the interaction of a particular structure and a person’s own psychological environment. In this theory, learning modifies the student's “world of knowledge” by interaction processes, so that he or she acquires new insights or changes old ones.

Activity-based learning (ABL) theory is a cognitive-learning theory which is considered a “constructivist” learning theory (Hein, 1991). Essentially, a learner “constructs” his own microcosms of knowledge from past knowledge and/or current experiences and interacting with data. He or she actively seeks new information, and is actively engaged in the process in the way s(he) gains, assimilates, and utilizes knowledge. The facilitator engages learners in outlining real-world problems in the first place instead of starting with a classification of problem-solving methods. (Therefore, the theory is also referred to as problem-based learning theory). Integrating ABL elements is thus a promising way to enhance students’ learning experiences. Vital learning principles include (Figure 2, see in detail Hein, 1991):

| Learning is an active process: A student needs an input of “doing”, and is engaged with the world, from which the learner constructs a meaning, as well as systems of meaning. |
| Learning is engaging: Teachers need to provide activities that engage the mind as well as the hands. |
| Learning is a social activity: Learning experiences are connected with other human beings (e.g., teachers, peers). |
| Learning occurs contextually: Learning experiences are interwoven with life experiences. |
| Learning builds on previous knowledge: Teachers' efforts must be connected to the state of the learner and provide a path into the subject based on his/her previous knowledge or experience. |
| Learning takes time: Students need to revisit ideas, ponder them, try them out, play with them, and use them. |

Figure 2: Intended Course Schedule and realized Course Schedule

ABL is not a completely new teaching style because it can be traced back at least as far as Socrates and Humboldt. However, it has been rediscovered by progressive educators such as John Dewey (Dodge, 1998). For a long time, it seemed that universities neglected to think
about the process of learning, since it is a highly active process in which it is imperative to convince students to speak, read, write, and think deeply (Dodge, 1998). “The thinking required while attending class [traditionally has been] low level comprehension that goes from the ear to the writing hand and leaves the mind untouched” (Dodge, 1998). In contrast, the success of ABL is to make students feel responsible for their learning and to support their own individual development (Cohen, 1990).

For several years ABL has been implemented in teaching-learning curricula in a variety of settings from private schools (e.g., Montessori schools) to universities. Applications can be found in medicine, science and engineering and more recently, also in operations management classes (e.g., Kanet and Barut, 2003). Recently, the Harvard Business School even created a committee on activity-based learning aimed at integrating students’ extracurricular activities with their academic experiences in the classroom.

There is little relevant scientific literature about statistics courses in operations management (OM) addressing specific needs of PhD students in transitional economies. However, we can build on the experiences made by Burton (2003) reporting on typical problems of statistics classes at the PhD-level in Australia. For example, instructors cannot take for granted that students have advanced skills in data collection, particularly in developing surveys, or well developed skills in formulating a specific hypothesis. “Empirical Research in Operations Management” - a course established by Charles J. Corbett (Decisions, Operations and Technology Management), Anderson School of Management at the UCLA (University of California, Los Angeles) - has similar objectives to our course. However, given that specific learning environment, Corbett spent about half the course time critiquing empirical papers in OM, emphasizing the logical correctness of the study and the underlying empirical research methods, and the preparation of an empirical term paper. With efforts to reform university
teaching in China, Chinese scholars support the notion that the traditional (passive) way of learning is not sufficient since companies have changed in terms of what they require from students. Instead, participation and giving students the time to explore issues is vital to long-term success in China. Therefore, Chinese universities want to promote dualism and offer active learning experiences (Sun and Zhang, 2007; Che, 2008).

3 Description of the Course and its Activities

3.1 Course Duration and Requirements

This course was part of the PhD program offered to doctoral students and junior faculty at the School of Management at Jilin University (JLU), a leading University in China (The host university is shortly described in Appendix 1). The course is part of the university's continuing effort to expose young scholars to the work of international scientists.

The course was offered to a limited number of students (up to 50) ten double sessions; it took place at the end of the week from 1:30pm to 5pm. To allow time for content repetition and additional group work, sessions were often extended from 210 to 270 minutes. Altogether, each student received around 42 hours of instruction. It is worth noting that the teaching time was extended due to additional one-on-one training during office hours which gave participants the opportunity to share their experiences, the problems encountered in research methodologies and to discuss possible ongoing strategies.

In order to provide learning opportunities to all PhD students at every level and junior faculty, we did not require any pre-requisites or qualifications. Participants came from all business departments. Recognizing individual time-constraints, it was not expected that
participants attended all sessions, although they were required to attend at least eight of them. Upon successful completion of this seminar, every participant received a seminar certificate. The course design was presented to faculty for discussion and ratification, and this led to the suggestion of a short introduction to the roots of European research history. The background of the facilitator is outlines in Appendix 2.

As all courses in a PhD program, the course has a tremendous impact on the research quality and working attitude of the students in regard to their gained doctoral education before they enter life in business or research.

3.2 Learning Outcomes

Through the integration of ABL elements we aimed to enhance learners' management knowledge, skills, and problem-solving abilities. Specifically, upon completion of the course students were expected to have the ability (see Figure 3):

| To demonstrate awareness of the range of statistical support that is available to scientific researchers, and to be able to apply the ‘right’ techniques at the ‘right’ moment. |
| To exercise critical thinking skills while assessing the quality (e.g., rigor and relevance) of an original scholarly article by identifying strengths and weaknesses. |
| To explain a chosen quantitative methodology and thus strengthen confidence in the application of statistical techniques. |
| To communicate professionally to different recipients both in oral and written form. |
| To incorporate information into their own statistical research and show originality in the application of research methodologies. |

Figure 3: Selected Learning Outcomes of the Course
The aim of this course was not to develop professional empirical researchers, as that would require a much longer and more intensive program. For example, a typical introductory course in Lisrel (a specialist statistical program) takes three full-days of extensive training (see http://www.ssicentral.com/workshops/lisrelbegin.html). Rather, the course objectives were to brush-up and broaden the horizons of participants, to introduce them to a range of research methods and paradigms with which they were less familiar. In line with the intention of ABL, we intended to help participants prepare for further study on the specific methods they are conducting, contemplating, or pursuing in their own research projects. As such, we tried to motivate student curiosity about new statistical methods and encouraged the students to delve into methods that, due to the scope of the course, could be dealt with only in a limited fashion. Thus, the course stressed life-long learning.

We summarized the learning goal presented in the introductory training: “I want you to learn statistics, but I don’t want you just to understand the concepts - I want you to understand where to get the concepts and where they come from.”

3.3 Principles of the Course Design

While ABL reflects the “philosophy” of the course, we based the course design on the following objectives (see Figure 4) so as to address the specific students’ situation (see section 2):
**Simplicity:** Statistics should be “explained as simply as possible, but no simples” (without “dumbing down”) - we followed Albert Einstein's aim in physics teaching.

**Modularity:** Sessions were designed to be self-contained, enabling time-constrained students the freedom to attend. Repeating essential material at the beginning of the class helped avoid large knowledge gaps.

**Adaptation:** The course was constantly adjusted and refined according to survey instruments, e.g., about students’ learning preferences.

**“Modern” teaching style:** Learners were exposed to ABL as the state-of-the-art teaching style, stressing reflective inquiry through questioning and reflection.

**Advanced teaching material:** The content of the course focused on techniques as predominantly applied in the North American and West European research community, in particular in the POMS and Informs community. The inclusion of material rarely found in normal textbooks, and mainly only from published articles, facilitated exposure to and acquaintance with cutting-edge research.

**Breadth and comprehensiveness of the course:** While introducing a range of empirical methods including required methods (e.g., structural equation modeling), we ensured that all students received a well-rounded education in fulfilling the requirements of a modern PhD program.

**Total human development:** The course fostered not only intellectual development but also social skills (e.g., networking among students and faculty), and the acquisition of soft skills such as giving presentations and defending ideas.

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**Figure 4: Selected Design Principles of the Course**

### 3.4 Selected Contextual Factors of the Learner

A doctoral-level statistics course presents a challenge for both students and instructors. Typically, there is a wide range of student skills, different levels of previous knowledge, and varying interests. When a course is compulsory, a dislike of statistics or even a phobia of math may add to the complexity.

Given the specific environment in which we were teaching, we had to anticipate cultural-induced challenges in our course design. Typically, students in China were accustomed to being taught in often-overcrowded classrooms in a more authoritarian teaching style, which meant student questioning and lively discussions were rare. As a consequence, our participants typically learnt and acquired knowledge and skills as the result of observation, recall,
memory, imitation and replication. This is in contrast - even diametrical - to education in North America and Western Europe, which is traditionally based on a teaching style which fosters independent research, critical thinking, and participation and discussion in class. Thus, the biggest challenge for us was how to bridge the gap from previous cultural notions and expectations of Chinese education with a new ABL approach in course participants' learning experiences. The facilitator’s previous experience with domestic and non-domestic Chinese students helped to cope with these special factors.

To gain a composite picture of the student situation and to fine-tune our pedagogical strategy, we administered a survey in the first session before the training started to assess teaching preference, knowledge of statistics and problem-solving skills. Students rated various statements on a 1 to 5-point Likert scale ranging from “strongly agree” to “strongly disagree.” We evaluated the responses of 39 participants. The following provides a rough impression of the questions covered.

1. Overall knowledge in Questionnaire Development Process and Survey Research: By and large, the overall comprehension about surveys was good. 74% of course participants strongly agreed, stating that prior experiences prepared them to develop questions for a survey. Similarly, it helped them understand the variety of research methodologies. However, one out of four PhD students and junior faculty disagreed with the propositions that they gained experience in accurately performing business calculations (indeed this item received the lowest mean in this construct/area).

2. Knowledge and Higher Empirical Skills: As expected, empirical skills were not developed to any great extent. A little more than half the participants felt prepared by former courses in applying statistical interference hypothesis tests and predictive analysis (e.g.,
regression). Nearly one in two respondents stated that they did not gain skills in applying differences tests (e.g., ANOVA) and advanced methods such as SEM (Structural Equation Modeling) or PLS (Partial Least Square) Modeling. It seemed that, similarly to the U.S., participants focused on analytical methods and case methods (“Operations Research approach”) and not on empirical research.

3. **Problem-solving Skills:** A mixed picture was gained in this area. While the majority of the students had no problems in searching information in electronic databases, one person in three experienced difficulties when retrieving information from literature that is not available electronically. Participants felt very well prepared in working efficiently in teams and taking responsibilities for a process or specific result (teamwork). The lowest mean value was observed in the use of creativity techniques in team meetings (i.e., brainstorming); every third participant identified insufficient skills in that particular area. The highest standard deviation was observed for the item “evaluating a published paper”, and this reflected the different student levels in the course.

4. **Linguistic Skills:** Proficient linguistic skills in English were expected although students had widely varying English oral and writing skills. 48% of the students agreed that prior courses fostered oral presentation skills while 45% disagreed - nearly none of the students remained ‘neutral’ on this issue. Three out of ten students identified a lack in their business-writing skills. There are many reasons for this. As in many Chinese universities, students have compulsory English classes and are exposed to English 'Powerpoint' slides in “bilingual courses” (which, however, are usually taught in Mandarin) but this resulted in variable levels of English proficiency. Some students had returned from visiting positions in the U.S. or Germany.
5. Preferences in Teaching Style: In business education, five different generic teaching styles can be distinguished - see at length Stößlein and Kanet (2008) who applied problem-based learning in SCM with undergraduate students. The highest preference was given to a teaching style that outlined a problem, before applying possible methods and finally a solution approach (80% of the students agreed). By contrast, the pedagogical strategy - that starts by explaining methods and exemplifying them in the next steps - was given the lowest preference (although more than 60% agreed). A middle position (although 10% do not regard this teaching style as valuable for life in business/research) went to a teaching style that starts by outlining a research issue and giving students an opportunity to investigate it for several weeks under guidance.

6. Degree of Satisfaction with Previous Instructor's Way of Interaction: Students in the sample indicated that they are most satisfied with previous instructors who speak slowly and use simple language. More than 60% explicitly wished to be involved in class discussions. As expected learners considered that textbook teaching was the least preferable option that was confirmed by three out of ten students. 55% of the participants in our sample were accustomed to using journal articles.

We expected a high number of students to have limited time to prepare or revise course content due to their thesis preparation and involvement in teaching. Despite this, our midterm survey revealed the great extent to which participants were industrious and eager to learn. The self-assessment showed that participants prepared or reviewed their work for an average of four and half hours per week. They also thought that their classmates spent three hours preparing for each double session (e.g., conduct analysis, review examples). However, this may be partly due to the fact that completing ABL-based projects is more time-consuming than a traditional technique-based course since ABL forces participants to spend time
on the ‘right’ questions, and not just to listen to ‘answers’.

3.5 Session Overview

In the course we dealt with a range of topics covering the fundamentals of statistics and “innovative” methods such as the Partial Least Squares approach. We emphasized, however, the methods that are commonly used in supply-chain management research.

We constantly adjusted our teaching program since it was part of our goal-shifting from a predefined technique-based learning to an activity-based learning course grounded in learners’ needs, expectations, actual research problems and situations. For example, it turned out to be useful to repeat how to interpret statistics and to insist on further analysis of why graphs found in newspapers are sometimes misleading. Furthermore, we found out that less content can bring students a greater understanding of what empirical research really is all about. Therefore, we did not cover structural equation modeling to any great extent but only introduced the basics.

The following Figure 5 illustrates two session overviews - the original one and an updated one that we adjusted in order to allow for the specific students’ needs and situations (see section 2).
<table>
<thead>
<tr>
<th>#</th>
<th>Planned Schedule</th>
<th>Selected key words</th>
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<tbody>
<tr>
<td>1</td>
<td>Types of research</td>
<td>European research history, types of research</td>
</tr>
<tr>
<td>2</td>
<td>Questionnaire Design</td>
<td>Survey workshop</td>
</tr>
<tr>
<td>3</td>
<td>Reliability and Validity, Missing Data, &amp; Data Imputation</td>
<td>Core Methods for Empirical Research</td>
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<tr>
<td>4</td>
<td>Descriptive Analysis</td>
<td>The Questionnaire Development Process I</td>
</tr>
<tr>
<td>5</td>
<td>What constitutes good research?</td>
<td>Reliability and Validity</td>
</tr>
<tr>
<td>6</td>
<td>Reliability Analysis, Factor Analysis</td>
<td>The Questionnaire Development Process II</td>
</tr>
<tr>
<td>7</td>
<td>Hypothesis testing</td>
<td>Descriptive Analysis</td>
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<tr>
<td>8</td>
<td>Differences analysis</td>
<td>Descriptive Analysis II, Reliability and Validity</td>
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<tr>
<td>9</td>
<td>Nonparametric Tests</td>
<td>Reviewing I</td>
</tr>
<tr>
<td>10</td>
<td>Regression Analysis</td>
<td>Reliability</td>
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<tr>
<td>11</td>
<td>Logistic Regression Models</td>
<td>Inferential Analysis</td>
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<tr>
<td>12</td>
<td>General Linear Models</td>
<td>Factor Analysis</td>
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<tr>
<td>13</td>
<td>Partial Least Squares Modeling</td>
<td>Reviewing II</td>
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<tr>
<td>14</td>
<td>Confirmatory Factor Analysis in SEM</td>
<td>Differences analysis I</td>
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<tr>
<td>15</td>
<td>Structural Models in SEM</td>
<td>Rigor versus Relevance</td>
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<tr>
<td>16</td>
<td>Multi-group Modeling in SEM</td>
<td>Differences analysis II</td>
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<tr>
<td>17</td>
<td>Individual research project presentations</td>
<td>Nonparametric Tests</td>
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<tr>
<td>18</td>
<td>Reviewing</td>
<td>Predictive analysis</td>
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<tr>
<td>19</td>
<td>Team project presentation</td>
<td>Structural Equation Modeling (Overview)</td>
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<tr>
<td>20</td>
<td>Team project presentation</td>
<td>Individual and team project presentation</td>
</tr>
</tbody>
</table>

Figure 5: Intended Term Schedule and Realized Term Schedule

3.6 Class Activities

The course was a mixture of lectures, workshops, quizzes, individual methodological inquiries, and a collaborative project (“learning by doing”), as well as writing and presentation exercises. Each student was expected to take part in several activities, all contributing to understanding the nature of research methodologies in general and, specifically, to excel in the particular techniques that were required for an individual participant’s research success.

In the following, we describe and comment on the course's road map (see Figure 6) and selected class activities. Further details can be found on the course website.
3.6.1 Methods and Skill Trainings

Each session reflected three different course levels. The first part of each session, around 15-20 minutes, recapped the essentials from the previous lecture. The second part of each session provided explanation of the theory underlying each technique. This introduced students without previous relevant knowledge to the theoretical background, whilst enabling experienced students to brush up their skills. Basically, this covered undergraduate and graduate course work while avoiding teaching in the standard “cookbook” format. Instead we used the technique of “storytelling” that interweaved statistics with historical notes on famous statisticians, everyday examples, individual experiences from the instructor, and so forth. The third part of each session was aimed at making participants intelligent users of these techniques so they could apply them in their own research, interpret the results and critically evaluate research done by others.

Before each session, students received “lecture notes” (part of a script) by email. The script was not intended to be a substitute for the training sessions. Rather its purpose was to
save students' time and effort in taking notes. Nevertheless, students were required to provide their own remarks or to do calculation exercises. To ease the understanding of key expressions, we translated around 20-30 key words from English to Chinese at the end of each script chapter.

The first lecture aimed to immerse students into the role of a statistical researcher, to introduce types of research and the pedagogical strategy of the course (see outline of first session in Figure 7). For example, in a historical sketch we outlined what research meant to Socrates, Aristotle, Descartes, Planck and Heidegger, to name but a few. In terms of the focus on supply-chain management research, we highlighted an article by Gupta and others who investigated which types of articles were published from 1992 to 2005 years in the POMS Journal; this revealed that articles based on empirical data have increased substantially, from 30 to 50 percent. This also enabled us to introduce the most frequently used data-analysis approaches. For survey process, we highlighted the fact that mistakes made in data collection and analysis were nearly impossible to correct at a later stage; this gave students some introductory tips for avoiding time-consuming mistakes in data analysis. In addition to this academic content, we also made time to introduce each other in English and Chinese. Finally, expectations about the course were recorded with a questionnaire.

<table>
<thead>
<tr>
<th>Part</th>
<th>Title</th>
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<tbody>
<tr>
<td>1</td>
<td>Why is empirical research important?</td>
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<td>2</td>
<td>Self-Introduction: Who's Who?</td>
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<tr>
<td>3</td>
<td>The 1st Questionnaire: What are your expectations about the Course?</td>
</tr>
<tr>
<td>4</td>
<td>Pedagogical strategy and course design</td>
</tr>
<tr>
<td>5</td>
<td>What is research - what is not?</td>
</tr>
<tr>
<td>6</td>
<td>Types of scientific research</td>
</tr>
<tr>
<td>7</td>
<td>How to summarize and analyze data?</td>
</tr>
<tr>
<td>8</td>
<td>Quiz</td>
</tr>
<tr>
<td>9</td>
<td>Conclusion and next steps</td>
</tr>
</tbody>
</table>

Figure 7: Outline of the Introductory Session
In the following lectures, all phases of the “life cycle” of a typical empirical research project were covered. The second session dealt with the collection of data, enabling the students to develop a research design, formulate research questions and/or hypotheses in a clear and concise fashion, to effectively and efficiently prepare survey questions, to collect and access data.

From the third session on, we aimed at analyzing data with statistical techniques, to interpret results, to formulate relevant conclusions. We covered topics such as the analysis of multivariate data. For example, we sequentially introduced structural equation modeling (SEM), e.g., measured variable path analysis, confirmatory factor analysis (and related topics such as construct validity/reliability), and latent variable path analysis. We also included discussions on multi-group analyses and practical guidelines on how to present SEM results in substantive manuscripts.

3.6.2 Calculation Exercises in Class

To assist participants in building a personal library on calculation expertise, instructor-prepared handouts with exercises were distributed during class sessions.

Besides calculation exercises, we offered multiple-choice quizzes (with three to five possible answers) both at the end of the session and also spontaneously during the class. Quizzes were developed in such a way that they played more of a learning role than just assessment. Students were allowed to answer in groups of three to five. From time to time, we also conducted group competitions. To assure that the average knowledge level in each group was similar, the instructor made sure that one or two “statistics whizz-kids” were placed in each group.

There are many advantages to this kind of class activity. First of all, quizzes assist active
learning by supporting both the personal construction of understanding and mastering of the teaching material. Secondly, quizzes contain intrinsic feedback, i.e. participants get to know how close they are to performing well or underperforming. Third, the group formation makes students talk about things they have learned, share experiences, and explain or recap material in their own words. Finally, group competitions gave additional motivation to participate in the class activity and thus build self-confidence.

The following Figure 8 illustrates selected activities.

| Activity 1: Comparing family incomes, employee income, Super Bowl winners, social class and first job |
| Activity 2: Describing annual research and development expenditures |
| Activity 3: Describing sales figures, evaluating the performance of funds, department store survey, |
| Activity 4: Predicting car sales, cold remedies, survey among dog owners about pet food, improving customer service data from a auto online-website |
| Activity 5: Comparing habits of online and offline newspaper readers Seat belts safety, analyzing differences in Lifestyles between countries, Predicting car purchases, fast-food sales, car sales and average salary, Advertisement for restaurant, Cold remedies, comparing upscale sedans and reliability, |
| Activity 6: Monitoring fill rates of boxes, failure times for hardware components, analyzing waiting time in fast-food chain, decision on purchasing a maintenance contract, defective parts in inspection process, determinants of home values, process control with computer supplies, student performance indicators, analyzing time needed to mix a batch of material, |
| Activity 7: Job satisfaction rating for employees, company recruiters on campus, analyzing manager expectations, past academic achievements and present achievements, family size and abilities |

Figure 8: Selected Activities

3.6.3 Scholarly Readings and Discussion

One of the core questions we examined in this class activity was what constituted good (quantitative) research by discussing the merits of excellent papers compared to less rigorous papers. Papers were summarized with abstracts, hypotheses and methods (e.g., path model) - see the following Figure 9.
3.6.4 One-Minute-, Two-Minute-, Five-Minute-Presentations

Each participant was expected to provide several presentations covering his or her research field(s) including their primary research questions, as well as a favorite (empirical or non-empirical) article and his or her ideal scientific researcher.

Course participants evaluated their peers with the help of a short assessment sheet. As an incentive, presenters received “bonus points” in their course assessment. The following Figure 10 illustrates selected activities.

Activity 1: Sales analyst presentation
Activity 2: Market research consultant (Which is the best survey mode?) for small tools manufacturer, regional bakery, entrepreneur with new hygienic product
Activity 3: Consultant for qualitative research
Activity 4: Moderator in focus group
Activity 5: Introducing questionnaire designs (improving customer satisfaction, service level of supplier)
Activity 6: Operations manager presentation in front of top managers
Activity 7: Reviewer’s presentation in front of conference audience
3.6.5 Paper Reviewing

Students had the opportunity to switch into the role of reviewer in order to get to know the "other" side of research. We provided checklists about factors contributing to rigor and relevance and also touched on the rigor-relevance debate. To fulfill the needs of this heterogeneous group we covered different research methodologies, in particular, operations research, IS research, and the emerging field of entrepreneurship.

Around every second session, students prepared short one-page reviews evaluating recently-published articles. The review was meant to be an analytical critique, rather than merely a summary, and provided several benefits. First, it forced students to study the underlying empirical research method in greater detail than can be introduced in the classroom. Second, it showed students how papers in different types of journals are prepared. Third, it reflected the students' own work. Finally, students further enhanced their linguistic skills in writing and presenting their work. The following Figure 11 illustrates selected activities.

Activity 1: What characterizes a fast-growing firm  
Activity 2: Evaluating producers’ attitude toward biotechnology  
Activity 3: Entrepreneurial types among European graduates  
Activity 4: Evaluating benefits of Supplier from Information Technology  
Activity 5: Evaluating E-Commerce Scenarios in China  
Activity 6: Strategic Planning as learning process  
Activity 7: Human resource management, Manufacturing Strategy, and firm performance  
Activity 8: Moderating effects in the relationship between communication skills and marital satisfaction  
Activity 9: Evaluating the effects of product category attitude and the mediating role of cognitive responses

Figure 11: Selected Activities
3.6.6 Technical Briefings

In technical briefings, we presented typical empirical problems through annotated examples, together with the statistical output achieved by contemporary statistical software packages; this was achieved by illustrating screen-shots or by software demonstration. Many of the assigned exercises required the use of a computer.

Noteworthy is that students were provided with an overview of several statistical software packages only after the theory was explained with a calculation example. However, this approach frustrated some students who believed that a statistical software program can do the analysis on its own and who were only interested in the meaning of tests they found in the program.

We introduced Microsoft Excel add-ons (from text books), SPSS, SPSS Amos, SAS, and Lisrel, primarily for new users. Since we used up-to-date software, there was no need to become familiar with the command-line syntax used in other software. Contact with several different statistical software packages made students learn about the strengths and weaknesses of those packages.

The following Figure 12 illustrates selected activities.

| Activity 1: Survey about preferences in restaurant |
| Activity 2: Analysis of automobiles |
| Activity 3: Evaluating the performance of funds |
| Activity 4: Predicting car purchases, fast-food sales |

Figure 12: Selected Activities

3.6.7 Individual Research Projects

Since it is virtually impossible to cover SAS or SPSS Amos with their corresponding statistical tests in 60 minutes, students had the opportunity to explore techniques and
software in greater detail specializing on a topic of their choice and interest. We recommended that participants discuss their choice with their doctoral adviser. To address students' different needs, we also handed out a topic list offered at four levels: beginner, advanced, expert, and professional.

For successful completion of the course it was necessary for students to write a short paper (four pages) over the winter break (around eight weeks); in order to do this, they were required to specify a research problem, explain possible methods, optionally use a software package and show the context of their topic in relation to the course content.

Students had the opportunity to present a brief statistics problems and solutions session at a mini-student conference and a poster presentation after the last session to which faculty, Masters students interested in survey research, and selected business partners were invited. The final papers were handed out as short proceedings and thus shared with other students to increase their knowledge. Students were allowed to present their papers in English or Chinese or even mixed-language. Awards were given on the basis of the final reports and presentations. (This class activity was not completely finished at the time of the paper submission.)

The following Figure 13 outlines the time-line of this activity.

Figure 13: Time-line of the Class Activity ‘Individual Research Projects’
We recognized the importance of giving students confidence and motivation by reinforcing their strengths and opening up new ways for them to succeed. Accordingly, we provided guidance that was as easy to understand and as pragmatic as possible without neglecting the rigor of research requirements. We found that the simplest solution was the provision of checklists. Step by step, we started writing an abstract, then a table of contents, etc. For example, we delivered timely tips of how to succeed at every stage - such as outlines in Figure 14. In order not to overwhelm participants, we decided to send out these tips sequentially: basic, advanced, and professional tips.

| Business writing tips (e.g., how to write abstracts) |
| Writing exercises (e.g., annotated text samples, developing an argument, summaries and creative statements) |
| Tips of an art studio (e.g., visual design, poster presentations) |
| Presentations tips |

Figure 14: Selected tips

Timely feedback and various checklists helped participants to succeed. Since the general consensus in general learning theory is that students value the opportunity to reinforce their learning through interactive resources, we decided to offer this course activity during the winter break (around eight weeks) when many students are in their home towns and when the facilitator is in the U.S. Thus, we forwarded the coaching material by email and offered communication via MSN and QQ. By doing this, we also (unintentionally) integrated Online-Activity-based learning elements in a virtual global classroom experience.

### 3.6.8 Team Project

The course concluded with team presentations of small quantitative research projects reflecting methodological knowledge obtained throughout the course. The focus of the presentations were on choosing an appropriate research design, developing hypotheses, preparing an
extended research abstract using correct terminology, and professionally presenting the project sketch to a scientific audience with MS Powerpoint. Due to time constraints we used SPSS data found in a text book. Team awards were given on the basis of the final reports and presentations. (This class activity was not completely finished at the time of the submission of this paper.)

4 Preliminary Assessment on the Effectiveness of ABL

4.1 Student Feedback

4.1.1 Study Objective

A study examined the impact of ABL upon the course. The major objective of the assessment was to determine the extent to which students are in favor of ABL experiences compared to a traditional technique-based course and exam format. Furthermore, results can also improve the learning experience in subsequent classes.

4.1.2 Selected Hypotheses

We hypothesize that the adherence of ABL has a positive effect on three constructs (latent variables) for students: their knowledge, their problem-solving skills, and their self-confidence/satisfaction. As foundation for measuring the effectiveness of ABL serves the model of Kanet and Barut (2003). The authors have been successfully applied these constructs in previous educational research in a related teaching approach, namely problem-based learning among undergraduate students (see Figure 15, which illustrates the path model for our final assessment.)
The aforementioned course objectives (see section 3.3) represents the ‘measured variables’. However, for our preliminary assessment in this paper, we used each question in our mid-term assessment as a hypothesis. Thus, some of the propositions to be examined were (see Figure 16):

**Proposition 1:** The ABL component will help to increase participants’ skills in analyzing survey data. (Construct 1: Knowledge and overall empirical skills acquired in the course).

**Proposition 2:** The ABL component will develop participants’ oral presentation skills in English (2. Construct: Problem solving skills gained in the course).

**Proposition 3:** The ABL component will develop each participant’s personality step by step, in order to help him or her become an independent learner (3. Construct: Degree of self-confidence/satisfaction).

4.1.3 Instrument

Assessments involved periodic measurements before, during and after the course. It allowed us to conduct a confirmatory factor analysis using Structural Equation Modeling.

In this paper, we report on pre- and mid-term ABL surveys and compare those results pairwise by applying the so-called paired t-test (with $\alpha=0.05$). (We could only use the pre- and mid-term surveys, because the final sessions of the course have not yet been held due to the
We designed a questionnaire with a 5-item Likert scale with response options ranging from “strongly agree” to “strongly disagree.” To ensure understanding, items with statistical key terms were translated into Mandarin. Although all students were asked to complete the survey instrument, participation was voluntary. As all students participated in the survey, non-response bias was not an issue. Demographic data such as age or gender were not collected.

4.1.4 Results

We present selected early results on the effectiveness of ABL. Underlined in Figure 17 are statements which significantly improved during the course.

<table>
<thead>
<tr>
<th>1. Construct: Knowledge and overall empirical skills acquired in the course</th>
</tr>
</thead>
<tbody>
<tr>
<td>This course prepares you ...</td>
</tr>
<tr>
<td>... to understand the variety of research methodologies.</td>
</tr>
<tr>
<td>... to develop questions for a survey.</td>
</tr>
<tr>
<td>... to increase your skills in analyzing survey data.</td>
</tr>
<tr>
<td>... to work with SPSS or other statistic software (not MS Excel).</td>
</tr>
<tr>
<td>... to learn &quot;how&quot; to read empirical research papers.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Construct: Problem solving skills gained in the course</th>
</tr>
</thead>
<tbody>
<tr>
<td>This course prepares you ...</td>
</tr>
<tr>
<td>... to efficiently work in teams.</td>
</tr>
<tr>
<td>... to improve your reading and listening skills in English.</td>
</tr>
<tr>
<td>... to enhance your business-writing skills in English.</td>
</tr>
<tr>
<td>... to develop your oral presentation skills in English.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Construct: Degree of self-confidence/satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am confronted with information overload.</td>
</tr>
<tr>
<td>I often work from deadline to deadline, i.e. I prepare assignments shortly before submission.</td>
</tr>
<tr>
<td>I am bored.</td>
</tr>
<tr>
<td>I appreciate team work with my colleagues.</td>
</tr>
<tr>
<td>I enjoy discussions with the instructor in class.</td>
</tr>
<tr>
<td>I became more and more an independent learner.</td>
</tr>
</tbody>
</table>

Legend: [underlined hypothesis] = significantly improved (alpha=0.05)

Figure 17: Pair-wise Comparison of Pre-ABL and Mid-term ABL Feedback (Fall 2008 and Winter 2008-09)

By and large, this part of the survey showed high achievement levels in the overall program and in specific learning outcomes. In particular, the greatest improvement for students was in their ability to perform business calculations accurately. Although reading and presentation
skills improved, business-writing skills have not yet shown any progress. The reason for this is that although students receive writing tips in form of checklists, they do not experience the extensive one-on-one lessons as provided in business writing classes. The final assessment of the course provides further insights into possible improvements.

4.2 Facilitator’s Feedback

It seems that students' high level of motivation and eagerness to gain knowledge and to participate enabled them quickly to adopt and enter into their modified student roles.

Due to the limited instruction time and heterogeneous knowledge level, more advanced topics could not be covered more deeply as had been planned. However, the focus on essentials brought students a greater understanding of what empirical research really is all about. Course participants are well-equipped for follow-up training to progress intellectually and to gain more specific technical-oriented skills using software packages for Structural Equation Modeling or Partial Least Square Modeling. Teaching modules in three two-day workshops seems a practical way forward.

5 Selected Good Practices in Implementing ABL

5.1 Instruction-based Practices

Based on our early success with the course format, we provide some ideas as to what seems to have fostered the participants' immersion into their ‘new’ students’ role, as promoted by ABL theory. In Figure 18 we outline some good practices for a typical course cycle:
1. Planning and adjusting the course

- prepare lecture notes with translated key words, distributing them some days before the session starts
- customize statistical problems to the region (e.g., use names of Chinese companies and regions)
- encourage negotiating aspects of the curriculum with students where it is feasible to do so
- build course on explicitly interdisciplinary material - in the selection of texts and readings – provide students with a platform to speak and present in English
- cover simple statistical tests (t-test, Anova) in detail, and move rapidly to a wide range of techniques to generate interest (e.g., structural equation modeling)
- use an approach that fosters students’ total development, i.e., cite histories of famous statisticians
cater for individual needs in mixed-ability groups to ensure that every student is given the opportunity to participate in every aspect of the learning program
- build course on interactive collaborative projects both in and outside the classroom
- coach students with real-world, international examples and SCM scenarios
capitalize on students’ publications plans and give them an opportunity to customize their learning to their own development plans.

2. Coaching in class

- practice reading and interpreting misleading statistics (despite the above-average mathematical skills of Chinese students)
- create a scholarly community among participants, to empathize and to connect (students need to feel part of a supportive group with shared interests)
- facilitate students' development of a sense of commitment to “their” learning programs
- convince participants of the advantages of doing calculations, writing notes during sessions, formulating questions, and exploring problems on their own
- reinforce learning experiences by using state-of-the-art statistical programs
- let student groups explain content to each other in their mother tongue
- foster competitive situations with group exercises (e.g., quizzes)
- promote networking among students of different PhD levels
- “do as the Romans do” - acknowledge habits and speak Mandarin
- speak slowly, limit colloquial speech, and repeat essential content (the facilitator's German heritage helped him to appreciate the difficulties of second-language learners)
- practice critical-reading exercises, let relevant information identify and key arguments synthesize
- by being passionate about work, serve as a role model
- invite students to submit their own “live” problems for course discussion and personal action.

3. Evaluating and assessing

- collect feedback on an ongoing basis (e.g., survey, focus groups, teaching assistants)
- illustrate the benefits of ABL theory with empirical studies
- communicate course achievements to faculty and deans

Figure 18: Selected Instruction-based Practices

5.2 Faculty-based Practices

Another key factor for success of the course was that the facilitator was allowed independence, intrinsic incentives and trust to design the course and coach the students. Commitment from faculty and deans was essential. Generous assistance on everyday issues allowed the
instructor to concentrate solely on research and teaching efficiently.

6 Conclusion

In this paper, we have outlined seven major steps aimed at enhancing a PhD program with activity-based learning experiences in Quantitative Research Methodology taught to Chinese participants at a leading School of Management.

The leveraged program reflects a marked change in teaching empirical research. At its core, the active individual learning experience, enhanced interaction between an instructor and course participants, and constant exposure to cutting-edge research taught in a foreign language is unique to PhD students in the given context. The course plays a pioneering role as it is the first course taught by a foreign instructor at Jilin University, and - to our knowledge - in survey research methodology at PhD level in China.

Given the positive feedback received, it is reasonable to conclude that the modified teaching strategy seems to be effective. Our teaching approach shows significant improvements for students' statistical knowledge and problem-solving skills, and also their degree of satisfaction. Equally importantly, participants appreciated the teaching style incorporating ABL experiences. However, since the assessment of ABL experience is at an early stage, a longitudinal study would be appropriate.

Although it is a small step in fostering ABL experiences in Advanced Quantitative Research, this course concept could also conceivably be applied to other areas in a PhD program. However, since the detailed course design needs to be constantly adjusted to allow for student needs, such a course can take longer preparation time, and requires more effort than teaching
a traditional technique-based course.
Appendix

Appendix 1: Background of the Host University

Jilin University is located in the heart of Changchun, which loosely translated means “Long Spring” due to the modest climate. Changchun is the 7-million-inhabitant capital city (without urban districts) of Jilin Province. Due to its automotive-industry focus (e.g., FAW cooperates with VW, Toyota, and others), the city is also called the (former) “Detroit” of China. In 2007, Changchun hosted the Winter Asian Games.

As with all leading universities in China, JLU is under the direct jurisdiction of China’s Ministry of Education. The university has more than 60,000 students, employs more than 3,000 professors and associate professors, and offers 120+ undergraduate programs, 200+ graduate programs, and 100+ doctoral degree programs. Recently, the School of Management organized the “2008 International Conference on Innovation and Entrepreneurship” in cooperation with the Global Entrepreneurial Center of Thunderbird University.

Appendix 2: Background of the Instructor

The facilitator has a background in industrial engineering and management, business information science, and operations management, and has been teaching at the university level since 2001. He had published papers on innovative techniques facilitating improvement in student learning, particularly in research-based operations management education. Moreover, the instructor has an extensive research and teaching experience in China due to his associa-
tion with Nanjing University, former participation in Sinology classes, and last but not least basic presentations and language skills in Mandarin. He has received three best-paper awards from leading national and international conferences as well as two awards from a well-known management consultancy. The instructor was supported by two PhD teaching assistants.

References


