

## **2005-2007 LITRE Grant Proposal**

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### **1. Project Title:**

Integrating a Factory and Supply Chain Simulator into a Textile Supply Chain Management Curriculum

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### **2. Project Coordinator:**

**First Name:** Kristin

**Last Name:** Thoney

**Campus Address:** Box 8301, TATM Department

**Email Address:** kristin\_thoney@ncsu.edu

**Campus Phone:** 515-6514

**Unity ID:** kathoney

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### **3. Other Participants:**

none

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### **4. College or Unit:**

Textiles

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### **5. Department:**

Textile and Apparel, Technology & Management

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### **6. Project Description:**

I plan to integrate Responsive Learning Technologies' new Supply Chain Game (SCG) into the new Textile Supply Chain Management undergraduate curriculum and our graduate supply chain management course. Responsive Technologies' Littlefield Technologies Game (LTG), a factory simulator, has been used previously in the graduate supply chain management course and will also be integrated into the Textile Supply Chain Management undergraduate curriculum.

Both the SCG and the LTG are simulations that are accessed over the Internet. The SCG was developed by Sunil Chopra and Philipp Afeche, professors at the Kellogg School of Management at Northwestern University. The LTG was developed by Sunil Kumar and Sam Wood, current and former professor, respectively, at the Stanford University Graduate School of Business. Each allows for 1 or 2 week games, which run 24 hours per day. Students are divided into teams and make decisions that affect the profitability of their enterprise. (Teams only need to monitor their enterprise a couple of times per day, and thus, the time commitment is not excessive.) Customer demand and operating capabilities are the same for each team. Teams compete against one another to see who can make the most money. (Additional descriptions of both pieces of software can be found at <http://www.responsive.net/>. More specific detail about the SCG can be found

at the trial version of the software that was set up for me at <http://sc.responsive.net/sc/thoneytrial/Assign1/> and <http://sc.responsive.net/sc/thoneytrial/Assign2/>. More specific details about the LTG can be found at <http://littlefield.responsive.net:8000/littlefield/littlefieldHome.html>).

Decisions that are made in the LTG include ones related to inventory, capacity, lot sizes, sequencing, and choosing contracts based on lead times. In addition, the SCG adds more complexity involving running distribution centers, selecting transportation modes, forecasting, and serving multiple types of customers in different locations.

I have taught TTM761, the graduate level supply chain management class, several times in the past. In it, I have used a combination of experiential and textbook learning. I teach textbook concepts in such areas as inventory, forecasting, queuing, and computer simulation. With regards to experiential learning, I have had students play the Distribution Game+ and the NCSU Supply Chain Game++ as well as the LTG. Students apply and integrate their textbook skills to solve problems in these games. I have never, though, systematically tested to see if these exercises actually improve student learning.

Incorporating the SCG into TTM761 should better prepare students for careers in supply chain management. Initially, I plan to use both the LTG and the SCG. I foresee the SCG possibly replacing the LTG since many of the concepts in the LTG are also in the SCG, and an advanced class like this probably would be able to jump to the SCG. In addition, the SCG offers much more complexity than the Distribution Game and is very different than the NCSU Supply Chain Game. The Distribution Game would continue to be played as a warm-up prior the SCG, and the NCSU Supply Chain Game would also be played since it has a different objective.

In regards to the undergraduate curriculum, LTG will be used in TAM380: Management and Control of Textile and Apparel Systems, an operations management class covering topics including inventory management, capacity management, and sequencing. This is a class that all Textile Management and Textile Technology majors are required to take. The SCG will be used in TAM486: Textile Supply Chain Management, the capstone course for the Textile Supply Chain Management Concentration in the B.S. in Textile Management. It is also an option for the other concentrations in the B.S. in Textile Management.

The format of TAM380 is mostly lecture-based. A more hands on project will hopefully get the students more excited about operations management. While, TAM486 has not been taught for several semesters, it is now a concentration requirement and will be regularly taught. I intend to use a combination of textbook and experiential learning, similar to TTM761. However, TAM486 will be tailored to the abilities of an undergraduate class and will also build on the skills developed in other classes (including TAM380) in the Supply Chain Management Concentration. Until the LTG has been used in TAM380 for several semesters, both the LTG and the SCG will be used in TAM486.

The schedule that will be used is shown below. Ultimately, each of the 3 supply chain management classes I teach will use either the LTG or the SCG, if they are deemed effective at improving learning. At this point, I am reluctant to force students in all of these classes to pay to use the simulations when I am not completely sure they are beneficial.

Spring 2006  
TTM761 LTG & SCG

Fall 2006  
TAM486 LTG\* & SCG  
TAM380 LTG

Spring 2007  
TTM761 SCG  
TAM380 LTG

\* will eventually be phased out when most students in TAM486 have had the LTG in TAM380

(TAM380 is offered in Spring 2006, but I would like to become more comfortable with the SCG before I run games in two classes at the same time.)

+The Distribution Game is a very simple simulation of a manufacturer, a warehouse, and retailer customers in which students determine the inventory policies of both the manufacturer and warehouse to satisfy the demands of the retailers. It was developed by Peter Jackson and John Muckstadt, professors in the School of Operations Research and Industrial Engineering at Cornell University. This software is free.

++The NCSU Supply Chain Game is a high level overview of a 4 member supply chain. Each student plays the role of one member of a supply chain and decides what to produce and what to order from their supplier each week. The game is usually played during one class period. The NCSU Supply Chain Game was developed by Russell King and Jeff Joines and is based on the Beer Game developed at MIT. It demonstrates the Bullwhip Effect and the potential to improve supply chain operations through collaboration between supply chain members. This software is free for NCSU students to use.

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## 7. Project Objectives:

The objectives of this project are two-fold:

1. To actively engage students in the learning process
2. To make students better decision makers by having them solve complex problems that are more like the ones they will encounter in the real world

While I believe that some lectures are necessary, the more you can actively involve a student in the learning process, the better they seem to understand

and retain material. Since most students these days have played video games since they were small, they are very comfortable with using the computer and competing against one another on it. Hence, using computer simulations to teach supply chain management concepts actively engages students in a familiar way.

It has been my experience that while most students can grasp individual ideas, they often have trouble applying several of them together to solve complicated problems. Both the LTG and the SCG challenge students to integrate problem-solving techniques to manage complex scenarios.

The long term impact will hopefully be that the students will have better problem solving skills that they are able to retain and apply to their future careers.

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### **8. Estimated number of students affected:**

Spring 2006

TTM761: 15 graduate students

Fall 2006

TAM486: 15 undergraduate students

TAM380: 50 undergraduate students

Spring 2007

TTM761: 15 graduate students

TAM380: 50 undergraduate students

Total Undergraduate: 115

Total Graduate: 30

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### **9. Outcomes of the Project:**

In accordance with LITRE's goals, this project will help improve problem-solving skills and, as a result, improve performance in the discipline of textile supply chain management.

Specifically, students will be able to make better decisions with regards to

1. inventory management
2. capacity management
3. lot-sizing
4. sequencing
5. satisfying demand
6. choosing contracts with varying lead-times
7. selecting transportation modes

Note: Depending on which of the 2 games students have exposure to and the specific scenarios for those games, not all of these will be applicable to each class. (For example, 7 will not apply to TAM380 since they will not play the SCG.)

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**10. Project impact on NCSU:**

As a result of this project, I believe that students will develop better critical thinking skills and thus be better prepared to undertake careers in textile supply chain management. The Textile Industry is still vital to North Carolina and supply chain management is a critical area of this increasingly global industry. This project will help NCSU in its mission as a land grant university to train future leaders of North Carolina's Textile Industry.

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**11. Project Assessment Plan:**

For every class, each student group will hand in a short write-up that describes what actions they took and what, in retrospect, they should have done with regards to each of the applicable areas in #9. I will give each group a separate evaluation in each area for what they actually did and what they think they should have done. A detailed rubric will be developed for each area and used in the evaluation. The intent of this comparison is to see if learning during a particular game occurred. In addition, for TTM761 and TAM486, there will be a least two write-ups, and I will compare the scores for the same area across different games. I will know that the exercises have been beneficial when the scores for the student's determination of what should have been done are significantly better than the scores for what they actually did and if the scores are significantly better for subsequent games. I will also distribute a questionnaire to the students asking them if they think the game(s) improved their learning in each of the areas.

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**12. Staffing and Support:**

Since the software is accessible through the Internet and does not require installation on campus computers, no staff will be required.

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**13. Financial Support Requested:**

**EPA salary total:**

**SPA salary total:**

**Other salary:**

**Equipment:**

**Cost associated with assessment:**

**Other financial support requested:** \$2850

**Total Funds requested:** \$2850

**Additional Explanation of how funds will be used:**

The LTG and SCG cost \$15 and \$20, respectively, for each student per semester. Each game can be played up to 2 times during the semester (2 scenarios with different parameters).

Spring 2006

TTM761 LTG & SCG: 15 students @ \$35 each = \$525

Fall 2006

TAM486 LTG\* & SCG: 15 students @ \$35 each = \$525  
TAM380 LTG: 50 students @ \$15 each = \$750

Spring 2007  
TTM761 SCG: 15 students @ \$20 each = \$300  
TAM380 LTG: 50 students @ \$15 each = \$750

Total \$2850

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**14. Funding Breakdown:**

**Total funding requested for fiscal year 2005-2006: \$525**  
**Total funding requested for fiscal year 2006-2007: \$2325**

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**15. Staff Support and/or Technical Support Requested:**

none

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**16. Timetable for Implementation:**

As previously state, the following is the timeline for implementation:

Spring 2006  
TTM761 LTG & SCG

Fall 2006  
TAM486 LTG & SCG  
TAM380 LTG

Spring 2007  
TTM761 SCG  
TAM380 LTG

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**17. Human Subjects Protection:**

If your proposal project involves research using human subjects, you will need approval from the Institutional Review Board for the Protection of Human Subjects in Research (IRB) prior to final approval. IRB information is available at <http://www.ncsu.edu/sparcs/irb>



**18. Proposal Release:**

By submitting this proposal the applicant grants the LITRE Advisory Board permission to make this proposal available as an example for future grant applicants. All personal information will be removed if this proposal is used as an example.

