Teaching Database as a Problem-Solving Tool:

Impact of Cognitive Load Theory in Learning Complex Skills

Catherine Chen
Joel Whitesel
Ball State University

Traditional Approach

- Lectures
- Recall and explanation of concepts by students
- No guarantee that students can apply and use the concept in a meaningful way (Julyan & Duckworth, 1996)
- Teaching strategies that encourage application, such as case analyses, are generally used only in upper-division courses

Effective Teaching Strategies

- In technology field
  - Many researchers report **what** to teach
  - Few report **how** to teach
- Modern learning theories
  - Constructivism
  - Cognitive Load Theory

Constructivism

- Learning is a process of knowledge construction, not absorption (Fosnot, 2005; von Glasersfeld, 2005)
- Learning requires the building of conceptual structures through reflection and abstraction (Duffy & Jonassen, 1992; von Glasersfeld, 2005)
- Learning occurs only when the learners are actively involved in the construction and reorganization of concepts (Schank, 1997)

Cognitive Load Theory

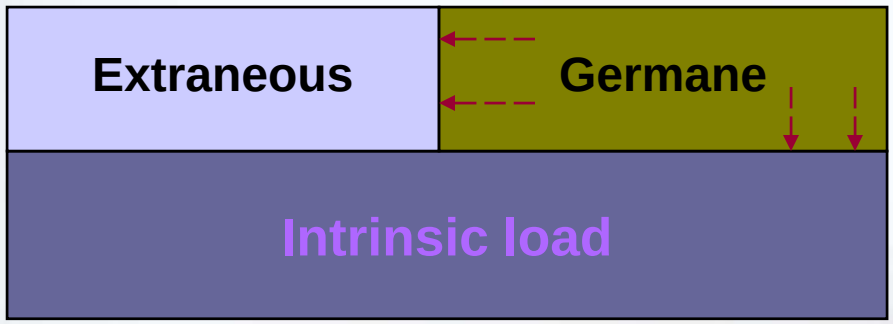
- A framework for cognitive process investigation and instructional design (Paas, Renkl, & Sweller, 2003)
- Basic assumption is in accord with constructivism
- The theory concerns:
  - Learning of complex cognitive tasks
  - Learners are often overwhelmed by the number of information elements and their simultaneous interactions
- Human limitation—limited capacity of working memory when dealing with novel information (van Merriënboer & Sweller, 2005)

Cognitive Load Theory

- Long-term memory stores cognitive schema
  - Schemas organize and store knowledge
  - A highly complex schema can be dealt with as one element in working memory (Miller, 1956; Simon, 1978; van Merriënboer & Sweller, 2005)

Types of Cognitive Loads

- Intrinsic—number of information elements and their interactivity
- Extraneous—information and activities that do not contribute to the processes of schema construction
- Germane—related to learning and constructing schema (Bannert, 2002)



Recommended Teaching Strategies

(Renkl & Atkison, 2002)

- Earliest stages
  - Study instructions (just-in-time) as they become necessary
- Intermediate stages
  - Use worked examples to introduce new topics
- Final stages
  - Problem solving

Research Hypotheses

When teaching using a database application as a business problem-solving tool, the use of just-in-time instructions and many worked examples will…

- Enhance knowledge development
- Increase knowledge retention

Research Questions

- Students in the treatment group develop schema more efficiently
- Students in the treatment group have better skill and knowledge retention
- Students in the treatment group are more skilled in using a database application to solve business problems

Research Procedures

- Subject: Students in two sections of an Advanced Microcomputer Application courses taught by the same instructor
- Groups
  - –Control group
    - Introduction of the software as a problem-solving tool and main functionality category, i.e., query, report
    - Demonstration of the functionality
    - Problem-solving activities at the conclusion of demonstrations
  - –Treatment group
    - Use reiterative teaching strategy that involves
      - – Brief just-in-time instructions
      - – Use of worked examples
      - – Problem-solving activities

Data Gathering Procedures

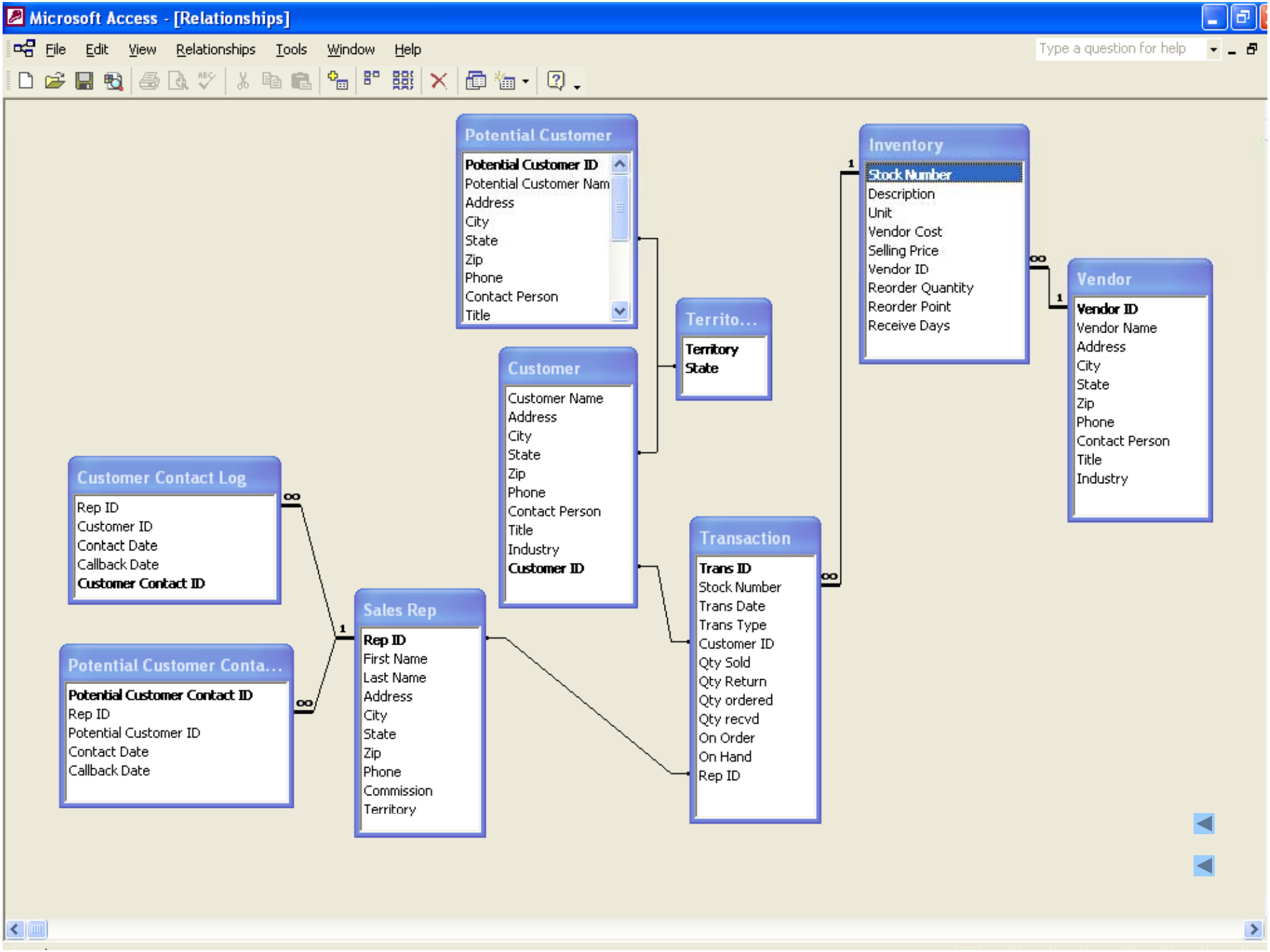
- Students' contribution to collaborative on-line notes
- Weekly quiz with open-ended questions to access students' schema construction
- Demographic questionnaire to assess the students' background information
- A problem-solving activity at the conclusion of the treatments to assess students' skills in using the tool
  - Video files that capture students' use of Access while solving a business problem
  - Access database files modified by students
  - Conclusions made and written by students at the end of the problem-solving activity
- An additional problem-solving activity at the end of semester to assess students' skill and knowledge retention

Data Analysis Procedures

- Qualitative aspect
  - Comparison of the results of quizzes and online notes
  - Comparison of the quality of students' conclusions in the problem-solving activities
- Quantitative aspect
  - Frequency counts and analyses of students' use of efficient and inefficient database procedures

Research Progress

- Four weeks of instruction on Access
- Student online note-taking collaboration in progress
- The first problem-solving activitiy in two weeks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