Introduction: Mathematics of Data Management

We agree with Dr. Selia Karsten that the constructivist way of working may fit many subjects and it may be particularly effective in online courses. In particular, research shows effectiveness of constructivist approach in mathematics. Currently, constructivism is the cornerstone of educational reform in mathematics. There is an interest in the holistic teaching of mathematics as well. For example, OISE/UT offers two graduate courses CTL1116 H Holistic Approaches in the Elementary Mathematics Curriculum and CTL1119 H Gaining Confidence in Mathematics: A Holistic Approach to Overcoming Mathematics Anxiety (K-8) taught by Dr. Rina Cohen.

One of the course designers agrees with Dr. Wayne Seller that "constructivism is clearly Transaction" because it is "more about how learners learn", not what they learn. The other course designer associates constructivism with the transformation orientation. Dr. Selia Karsten supports his opinion. However, both of us agree "one very holistic approach that has emerged to put constructivism into action is Project-Based Learning (PBL). PBL.infuses technology into learning activities in a very natural way" (Katz, 2000). The goal is to develop student's mind "in a way that develops not only cognitive processes but also emotional, aesthetic and spiritual contexts, as well as social relationships" (Katz, 2000). A PBL holistic approach is perfect for designing a Mathematics of Data Management course because the essence of this course is in developing skills for finding, using, and making sense of information.

Design of our course is inspired by following two sources:

(1) the website project created in Selia Karsten's summer course: Holistic Approaches to Information Technology by Brenda Sherry. "Bricolage, Connecting Playfully";
(2) Chao & Stovel's Nothing but the Blues: A Case Study in the Use of Technology to Enrich a University Course in Chapter 7 of "Designing Instruction for Technology-Enhanced Learning" by Patricia L. Rogers (ed) Idea Group Publishing, 2002.

Project-Based Learning (PBL) centers around a structure of inquiry that begins with the students' interests, in collaboration with the instructors. Students will be strongly encouraged to choose a topic for their final project they are passionate about. Project does not need to be limited to Internet search only. For example, students can investigate through observing wild life in neighbouring parks, interviewing members of their communities, field working in local businesses, volunteering in charitable organizations, and gathering information from a variety of sources. Based on their experiences in these activities, students make predictions and support their findings. In the process of gathering information, findings are recorded and shared with classmates through online conferencing for the purpose of receiving feedback from them. PBL exemplifies a holistic, bricolage approach since it involves knowing well your students and their community and using a wide variety of available resources (people, technology, knowledge, observations) to explore personally relevant topics deeply. The opportunity to capitalize on multiple intelligences to create diverse working groups and alternate

demonstrations of learning is prevalent. Instructors will guide students to ensure that the following features of PBL are realized in working on the final project:

• project inquiry comes from the personally relevant questions that children ask about the world around them (teachers help to develop 'fat' or deeper questions)
• process (rather than content), is emphasized and the challenge of teaching is to help students learn how to learn rather than to simply impart information
• the learner is the focus but the centrality of the teacher to guide the inquiry is critical
• large blocks of time and extended study of topics is usually required to promote depth, meaningful understanding and reflection
• the teacher's role is one of co-learner, guiding and promoting growth and development
• authentic experiences are encouraged to increase motivation and personal relevance
• learner-centered, intrinsically motivating
• collaborative
• challenging
• demonstrations of learning using a variety of techniques are promoted (posters, drama, models, simulations, multi-media presentations, text, music)

Mathematics of Data Management

This 12-week course is a mixture of face-to-face in-class meetings and online conferencing.

Course readings: Zimmer et al. Mathematics of Data Management. Thomson/Nelson, 2003.

Assignments:

Group Assignment: The power of Data – The Media

The media are major users of data. In addressing issues and presenting points of view, the media rely on information based on data. One of the main purposes of the media, as producers of mass communication, is to inform the general public about world events in as an objective manner as possible. Ideally, the information is accepted as being accurate; however, the media may sometimes provide misleading or false impressions to sway the public or to increase rating or circulation.

An important reason to study statistics is to understand how information is represented and misrepresented. The ability to correctly interpret tables/charts, diagrams, and graphs presented in the media is an invaluable skill.

As a group, discuss and answer the following questions:

1. What are the ways to display data properly?
2. What are the ways to misrepresent data?
3. How do you make sense of misrepresented data?

Each member of the group finds and shares with others an example of misrepresented data in the media. The group analyzes the examples and decides how to make sense of misrepresented data and how to display data properly.

Individual Final Course Project

Each student:

- formulates a research question whose study would require the organization and analysis of a large amount of data;
- selects and applies the tools of the course;
- compiles a fully justified report of the investigation and its findings.

Each week instructors would pose questions to stimulate discussions in the groups about the next step in planning and doing the project.

Components of the final project could include:

- General Introduction,
- Thesis Statement,
- Discussion of Sample Selections and/or Data Collection,
- Discussion of Analysis, (broken down by sub-headings) (demonstrates understanding of topics covered in the course)
- Highlights of Findings, (broken down by sub-headings
- Summary including conclusion to thesis
- Relevant Graphs and Tables included in relevant locations of report and referenced
- Formal Bibliography

In-Class Activities

During in-class sessions students will study mathematics foundation of data management: probability and statistics, solving problems with matrices, graphs, and diagrams. Students will work in cooperative learning groups with unrestricted access to various manipulative and technology.

Grading System

1.	In-class participation	10
2.	Online participation	10
3.	Conceptual and procedural knowledge	
4.	of mathematics foundation of data management	25
5.	Assignment # 1	15
6.	Final project	40

1. *What are the advantages and the draw backs of implementing constructivist principles in a course?*

A feature of constructivist approach, an authentic student task in a meaningful real-world context is a great source of students' inspiration and motivation to learn. This is a definite advantage. At the same time, the complexity of the authentic task involves more ambiguity and more cognitive challenges that may force a student to give up and to produce a lower quality learning outcome than expected by an instructor. This is a draw back.

2. What are some foreseeable problems if you were to follow the same principles in your course?

In our course we expect that students would choose too broad or too narrow topic for their final project. Students also may not find the project more challenging if they choose to not implement the ideas presented in class.

3. What are the benefits and challenges in integrating technology into a conventional course in higher education? How can you ensure that students have a valuable learning experience?

The benefits are: an instant one-stop access to all information required for the course, flexibility in space (students can leave in different parts of the world) and in time (you can contribute to discussion in early morning and in late evening, and you can do it many times during the week), potentially richer learning environment (e.g., you can easily add screenplays and animated learning materials or invite your students to a field trip on Internet). You would make a big step toward enhancing students' learning experience simply by directing them to multiple treasure islands found on the Internet. I had no any idea about existence of all these wonderful websites, like Bricolage, that Selia opened for us.