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INF5790 – Spring 2013

Lecture 8 – Domain-specific scaffolding

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Outline

- Scaffolding
- Two articles on domain-specific applications of scaffolding
 - Similarities
 - Differences
- The two studies
- Discussion

Basic idea put forth in this lecture

- Using the computer to provide scaffolding
- The studies report from two design experiments in Norway, using a mixed methods approach
- Comparing two groups of high school student: treatment group (w/scaffolding) and control group
- Common findings
 - Automated feedback noticed by all students (+)
 - Lack of critical reflection and a tendency to copy and paste text from the information given (-)
- Different findings
 - EssayCritic critic study showed that low achieving students scored better in the scaffolded situation (+)

Two articles

- Furberg, A. (2009). Socio-cultural aspects of prompting student reflection in web-based inquiry learning environments. *Journal of Computer Assisted Learning*, 25(4), pp. 397-409.
- Cheung, W.K., Mørch, A.I., Wong, K.C., Lee, C., Liu, J., Lam, M.H. (2007). Grounding Collaborative Learning in Semantics-based Critiquing. *Int'l J. Distance Education Technologies*, 5(2), pp. 40-55.

A study of automated feedback (prompting) in "Viten.no"

- Viten.no is a collaborative web-based inquiry learning environment
- Aimed at prompting students by giving them questions and opportunity for reflection during problem solving
- Subject of study: molecular biology (structure of DNA)
- Previous research showed that prompts used in web-based inquiry environment do not always have the intended effect on the students' learning
- This study attempted to find out why this is the case

Research question

- What opportunities for action are embedded within the web-based learning environment “Viten.no”, and how do these opportunities for action become structuring resources in the students’ participation in scientific inquiry
 1. In non-prompting situations
 2. In prompting situations

The viten.no user interface

The screenshot displays the VITEN website interface. On the left is a navigation menu with categories like 'Genteknologi (bokmål)', 'Gener', 'Proteiner', and 'Proteinsyntese'. The main content area features an animation titled 'Proteinsyntese' with the sub-header 'inne i cellekjernen'. A large number '1' indicates the first step: 'Det lages en kopi av et gen fra DNA i cellekjernen. Denne kopien kalles RNA. Start animasjonen og få en grundigere beskrivelse av dette.' Below this, it explains that DNA opens with an enzyme and new bases are added to form RNA, where Thymine (T) is replaced by Uracil (U). The animation shows a DNA double helix with an enzyme and a growing RNA strand.

Overlaid on the right is a task window titled 'OPPGAVE' with a 'Lagre' button. It asks: 'Hvorfor er rekkefølgen til basene i et gen så viktig?' and provides a text input field containing 'Den utgjør informasjonen om genet.'. Below the task window, a DNA sequence 'G C G T T T G G A' is shown with arrows pointing to amino acids: 'met', 'ala', 'leu', 'glu', 'leu', 'arg', 'lys', 'pro'. Text labels identify this as 'Del av et gen' and 'Dette er de første 8 aminosvrene i'.

Participants

- Two 10th grade classes of 25 students each
15-16 years old
- The teacher was in charge and carried out the project



Methodology

- Transcribed video material
- Students written response to the prompts
- This material was used to study the students engagement with the learning environment – both with and without prompts

Theoretical frame and concepts for analysis

- Socio cultural theory (Vygotsky and Wertsch
 - Mediated action while engaging with "viten.no"
- Michael Cole (Cultural psychology theory)
 - cultural artifacts
 1. Knowledge aspect - research, scientific discussions discoveries and scientific discussions
 2. The social practices aspect - knowledge on the practices on scientific inquiry

Findings

- Short and non-argumentative responses to the prompts
- "Copy and paste" strategy
- The students interaction contained explanations and elaborations in non-prompted situations
- The findings was partly explained by students' engagement with the web-based environments being driven by institutional expectations (finding right answers)

Paper 2: EssayCritic system and trial

- Motivation
- Theoretical inspirations
 - ZPD and scaffolding
 - Reflection-in-action
 - Latent semantic analysis
- Guidelines for design
- Design experiment in high school
- Results
- Discussion

Motivation and problem identification

- Many English as Foreign Language (EFL) students find it difficult to write essays of sufficient length
- They run out of ideas before the class is over
- Students of today are more exposed to oral literature (TV, film) than to written literature (books)
- It is demanding for a teacher to help all those who ask for assistance during writing classes
- It is also demanding for parents to help at home when they don't know the context for the assignment

Critiquing approach

- Critiquing is the presentation of a reasoned opinion about an artifact or action
- It can provide both critique and praise
 - Critique: What can be improved
 - Praise: What is good about a design
- Modeled after how design critics in design studios observe and provide feedback to students by “looking over their shoulder”
- Automated critiquing systems have been built to support novice designers in many domains

Theoretical inspirations for design of EssayCritic

- ZPD (Vygotsky, 1934/1978) and scaffolding (Wood, Bruner & Ross, 1976)
- Reflection-in-action (Schön, 1983)
- Domain-oriented design environments (Fischer, 1994)
- Latent semantic analysis (Landauer, Foltz & Laham, 1998)

Reflection-in-action

- Design is characterized as rapid transitions of action (acts of design) and reflection (on the spot thinking) to direct further design
- Reflection is triggered by “back talk,” which is feedback from the environment, including the partially completed design and other information available from the design situation
- This theory has been tested by Donald Schön and others in different design disciplines

Domain: English composition in EFL classes (writing as design activity)

Version 1

Unhealthy food and overweight

I think there should be rules against fast food in schools because its unhealthy. You don't only gets fat but also unconcentrated tired more sick and so on. Teenagers does less exercise in 2009 then before and therefore it's more impotent to eat healthy. People eat fats food because it taste good and it's cheap.

The two first versions of essay submitted by student22. After version 1, the essay was analyzed by EssayCritic

Version 2

Unhealthy food and overweight

I think there should be rules against fast food in schools because its unhealthy. You don't only gets fat but also unconcentrated tired more sick then usual and so on. Teenagers does less exercise in 2009 then before and therefore it's impotent to eat healthy food. People eat fast food because it taste good and it's cheap that maces sense but what most people don't think about is that fast food makes people addicted. If you eat every single meal from Mc Donald's you are getting tired and sick but even you don't feel good you want to eat more fast food. If the only food the students eat in school is fast food the bigger is the chance to eat it whenever you feel hungry. If children begins to eat fast food and we don't do anything about it the number of young people dying of cardiovascular disease will be higher.

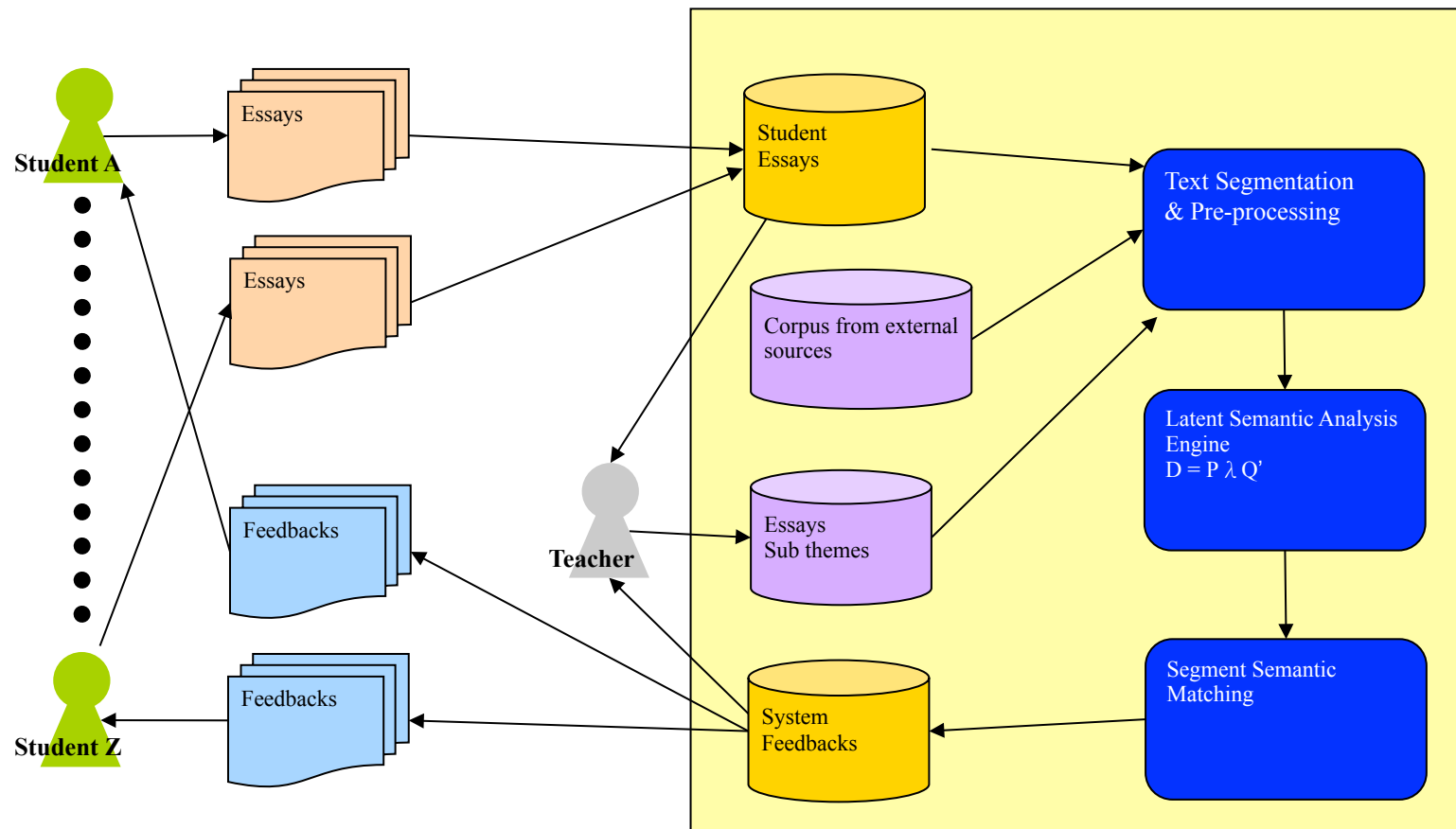
Latent semantic analysis (LSA)

- *A mathematical technique* for computing the semantic similarity between text segments using matrix algebra and statistical analysis
- Determining how different a student essay is with corpus of good examples (model texts)
- Larger and more complete corpus gives more precision in identifying steps to good essays
- Topics that are in the model texts but not in the students' essays can be detected and serve as a basis for critique presented in the user interface

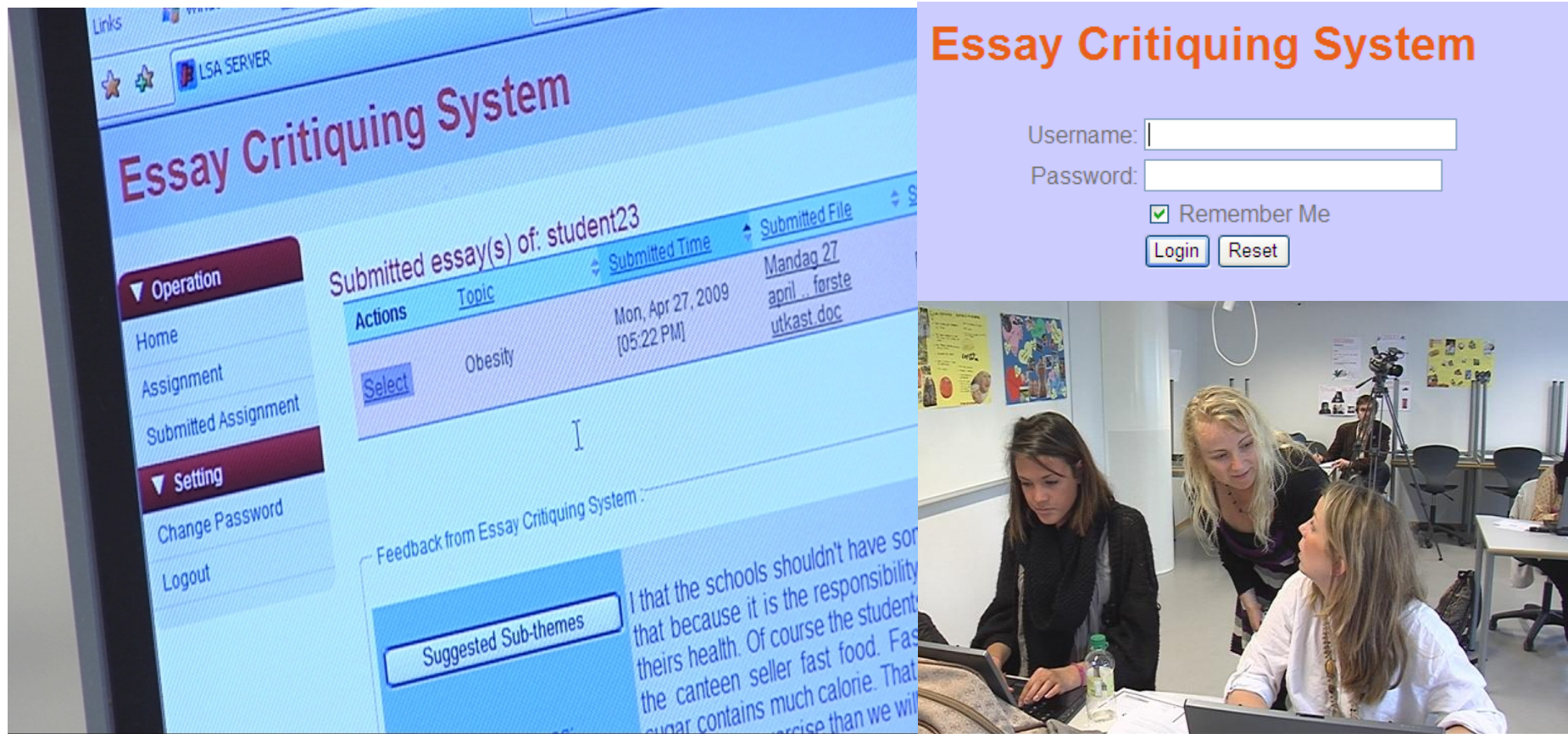
Design guidelines based on the theory

- Showing
 - How to provide examples for students to compare?
- Telling
 - Point out critical areas in text that should to be considered for revision?
- Timing of intervention
 - At what time should feedback be provided: Proactive, re-active, on-request?
- Intervention techniques
 - What should be the content of the feedback

System architecture



EssayCritic: User interface, login window, classroom setting



The assigned task in the experiment

UNHEALTHY FOOD AND OVERWEIGHT

The popularity of McDonald's amongst children is responsible for the growth of overweight amongst high school children. There should be rules against fast food in schools.

Do you agree or disagree with the statement? Use specific reasons and examples to support your opinion. Write 250-300 words about the topic.

Experiment group were asked to submit and revise their essays via EssayCritic up to three times before submitting to teacher.

Control group were submitting their essays directly to teacher.

User interface: critique mode

Text written by student22 on unhealthy food topic

Feedback from Essay Critiquing System :

Critique generated by computer

Covered Sub-themes

Unhealthy food and overweight

Suggested Sub-themes:

- Say more about: Ingredients of fast food.
- Say more about: Harmful effects on health.
- Say more about: Clear guidelines on fast food sold in school.
- Say more about: Education by school.
- Say more about: Amount of exercises.
- Say more about: responsibility of parents.

I think there should be rules against fast food in schools because its unhealthy. You don't only gets fat but also unconcentrated tired more sick then usual and so on. Teenagers does less exercise in 2009 then before and therefore it's impotent to eat healthy food. People eat fast food because it taste good and it's cheap that maces sense but what most people don't think about is that fast food makes people addicted. If you eat every single meal from Mc Donald's you are getting tired and sick but even you don't feel good you want to eat more fast food. If the only food the students eat in school is fast food the bigger is the chance to eat it whenever you feel hungry. If children begins to eat fast food and we don't do anything about it the number of young people dying of cardiovascular disease will be higher.

User interface: praise mode

Feedback from Essay Critiquing System :

Praise generated by computer

<p>Suggested Sub-themes</p> <p>Covered Sub-themes:</p> <ol style="list-style-type: none">1. <u>Fast food addiction.</u>2. <u>Healthy food in school.</u>3. <u>Chances of eating fast food in school after banning.</u>4. <u>Eating habit of children.</u>	<p>Unhealthy food and overweight</p> <p>I think there should be rules against fast food in schools because its unhealthy. You don't only gets fat but also unconcentrated tired more sick then usual and so on. Teenagers does less exercise in 2009 then before and therefore it's impotent to eat healthy food.</p> <p><u>People eat fast food because it taste good and it's cheap that maces sense but what most people don't think about is that fast food makes people addicted.</u> If you eat every single meal from Mc Donald's you are getting tired and sick but even you don't feel good you want to eat more fast food. If the only food the students eat in school is fast food the bigger is the chance to eat it whenever you feel hungry. If children begins to eat fast food and we don't do anything about it the number of young people dying of cardiovascular disease will be higher.</p>
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Design experiment in high school

- We studied 3 first year high school classes (age 16-17), health and social science, spring 2009
- Students worked together in grouped of 3-4, but all handed in individual essays
- The experiment were spread over three 1/2 days meetings (three consecutive weeks)
 1. Introduction and trial writing
 2. Running the experiment
 3. Evaluation and group interviews
- We made a [video](#) of the study (8 min)

(URL: <http://www.uv.uio.no/intermedia/tjenester/intermedia-formidler/essay-critic.html>)

Research methods

- Mixed method approach
- Qualitative study
 - Complemented by questionnaire and students grade point average in the course
- Data collection techniques
 - Essays in different stages of completion
 - Video and sound recording from 3 classrooms
 - Interview with selected students and teachers
 - Teachers grading of essays
 - Questionnaire
 - Observation notes
- Triangulation of data during analysis (drawing on multiple data sources to illustrate same phenomenon)

Quantitative results

	Treatment group	Control group
Total number of participants	18	14
Mean number of words	316.4	246.5
Standard deviation number of words	130.7	65.8
Mean essay mark	3.41	2.55
Standard deviation essay mark	0.92	0.68
Mean average mark	3.18	2.71
Standard deviation essay mark	0.92	0.72
Mean mark difference (x 1, not x 10)	0.23	-0.15

- Data indicates that grade point average increased by one grade for students who used EssayCritic. This was again based longer essays (in average 28%, or about 70 words longer essays in treatment group)

Qualitative results

- Encouraging
 - Many students found the EssayCritic useful and incorporated the critique in the next version of their essays
 - The lower achieving students seemed to benefit the most, and found the critique motivating, and stimulating them to write longer essays by including more ideas
- Discouraging
 - About 10% of the students found the critique distracting believed it would inhibit creativity, and wanted to figure it out themselves, or to search for ideas, using personally chosen sources like dictionaries, books, and Google
 - IN the essays written by the treatment group participants, the teacher found evidence of verbatim copy and paste from the system critique

Qualitative results cont'd

- Work in progress

1 st draft, 11:18	2 nd draft, 12:56	Final delivery, 13:25
<p>The popularity of McDonald's and other fast food outlets is an increasing problem in Norway. They sell their food cheaper than others with healthy food. High school children are often broke and it's much easier for a teenager without money to buy something at burger king then buy an apple in a store, and its even easier to buy something at your school. That is one of the reasons why teenagers today is more unhealthy then before. This food contains a lot of fat and unwanted sugar.</p>	<p>The popularity of McDonald's and other fast food outlets is an increasing problem in Norway. They sell their food cheaper than others with healthy food. High school children are often broke and it's much easier for a teenager without money to buy something at burger king then buy an apple in a store, and its even easier to buy something at your school. That is one of the reasons why teenagers today is more unhealthy then before.</p> <p>If you are overweight you can have a lot of health problems like, heart conditions and you can have cancer, these are all very dangerous diseases. There is a lot of people who don't work out. This is important because if we don't we are going to get sick.</p> <p>The food they serve in schools often contains a lot of fat, sugar and salt, and this food is cheaper then healthy food. They often sell sweets like chocolates and cookies in cafeterias and that kind of "food" is placed in the fridge, but fruits and vegetables are not. That is one of the reasons why they don't eat a lot of healthy food, because the good food isn't taken good care of.</p>	<p>The popularity of McDonald's and other fast food outlets is an increasing problem in Norway. They sell their food cheaper then others with healthy food. High school children are often broke and it's much easier for a teenager without money to buy something at burger king then buy an apple in a store, and its even easier to buy something at your school. That is one of the reasons why teenagers today is more unhealthy then before.</p> <p>If you are overweight you can have a lot of health problems like, heart conditions and you can have cancer, these are all very dangerous diseases. There is a lot of people who don't work out. This is important because if we don't we are going to get sick.</p> <p>The food they serve in schools often contains a lot of fat, sugar and salt, and this food is cheaper then healthy food.</p> <p>They often sell sweets like chocolates and cookies in cafeterias and that kind of "food" is placed in the fridge, but fruits and vegetables are not. That is one of the reasons why they don't eat a lot of healthy food, because the good food isn't taken good care of.</p> <p>The healthy food in the schools is minimal. In our school it's a salad bar and a few bad apples and thats it. It's not good enough. If they want teenagers to eat healthier, they need to get more and alternatives, then just some old fruit.</p> <p>One of the reasons why teenagers turn to fast food is because it is so cheap and easy, and it is of course also so good, it's almost addictive. It has the taste and some of it even look good, but it is so bad and it's not worth it.</p> <p>From children grow up, the eating habits of their parents is important. Because children look up to their parents, and the way their parents eat is a good way to eat. Thats why it is so important that schools educate the children to eat healthier.</p>

Möllenkamp, E. (2010). From talk to text production with EssayCritic: Scaffolds in the early phases of the writing process. Master's thesis, Dept. of Informatics, University of Oslo.

Summary and further work

- EssayCritic is a web application for automated feedback on student essays on given topics to motivate writing longer essays
- All students could use the program and most of them found it useful to support their writing
- Formulating and activating critique so that it will stimulate critical reflection and not “thoughtless” copy/paste is an important area for further work on critiquing systems