EssayCritic: Situational 'back-talk' based on latent semantic analysis (LSA) to support early-stage English composition

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Overview

- Motivation
- Theoretical inspiration
- Latent semantic analysis (LSA)
- EssayCritic system
- Design experiment in high school
- Results
- Limitations and open issues

Motivation and problem identification

- Many English as Foreign Language (EFL) students find it difficult to write essays of sufficient length
- The 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

Theoretical inspirations

- Lev Vygotsky
  - Zone of Proximal Development (ZPD)
  - Gradual steps to learning
- D.A. Schön
  - Reflection-in-action
  - Back-talk
- G. Fischer
  - Domain-oriented design environments

Reflection-in-action

- Design is characterized as rapid transitions of action (acts of creation) and reflection (on the spot thinking) to direct further action
- Reflection is triggered by “back talk,” which is feedback from the environment, including the partially completed design and other information available to inform the current situation

Essay writing as design activity

- Design
  - Choose/generate components (themes to write about)
  - Organize the themes
  - Critique uncompleted collections of themes (artifacts)
- Essay as textual artifact
- Artifacts evolve over time
  - From small to larger
  - From many ideas to a few central messages
  - Communicating the messages to readers
  - Feedback from reader (teacher, peer, parent, computer)

Textual development in a writing class

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.

Version 2

Unhealthy food and overweight

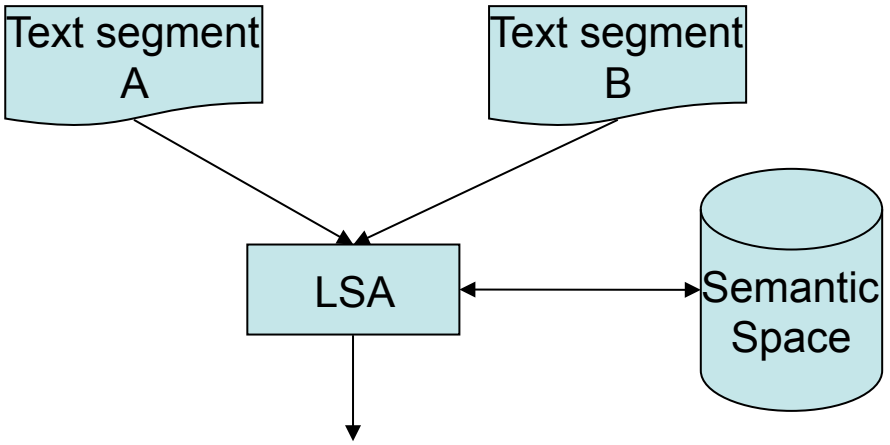
I think there should be rules against fast food in schools because its unhealthy. You don't only gets fat but also unconcentrated tired more sick then usual and so on. Teenagers does less exercise in 2009 then before and therefore it's impotent to eat healthy food. People eat fast food because it taste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

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

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

Computing semantic similarity

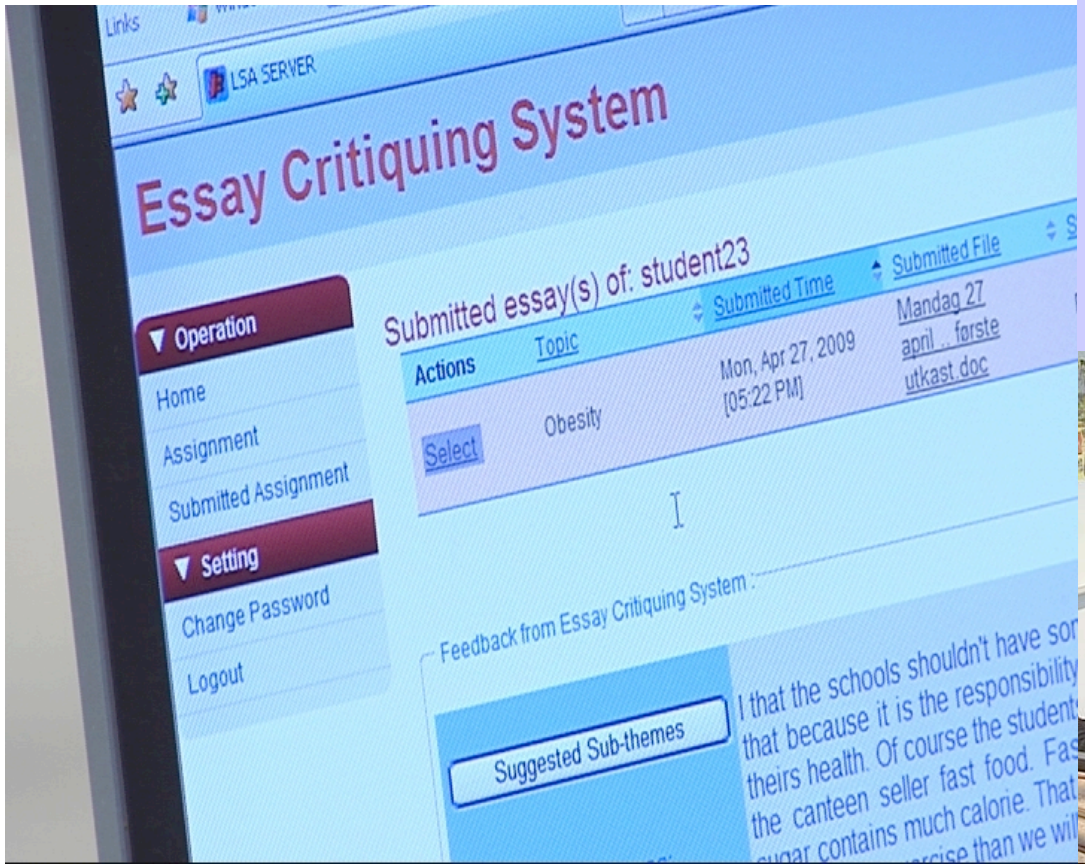


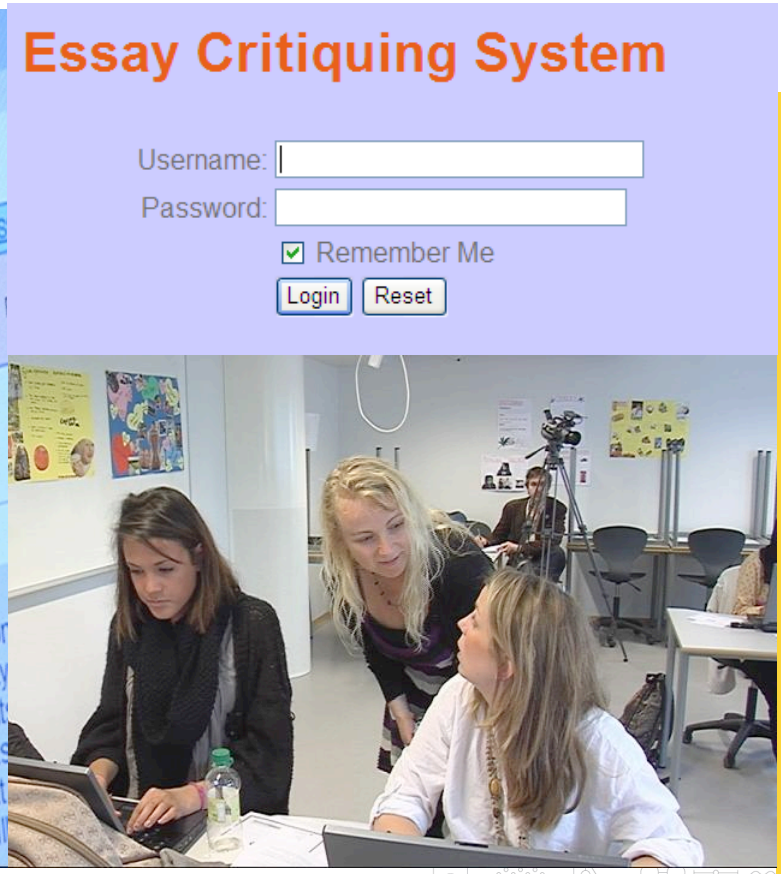
$\cos\theta$	Semantic Similarity between Segments A & B
$\cos\theta \rightarrow 1$	Very High (good match)
$\cos\theta \rightarrow 0$	Very Low (poor match)

LSA-based critiquing

- LSA can implement situational “back talk” as a computational mechanism for textual artifacts
- Using LSA we can address uncompleted essays (what is missing) for a given topic, comparing with good examples collected by experts
- The EssayCritic gives two forms of feedback
  - Critique (missing themes)
  - Praise (covered themes)

EssayCritic: User interface, login window, classroom setting





The assigned task

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

Critique generated by computer

Feedback from Essay Critiquing System :

Covered Sub-themes

Unhealthy food and overweight

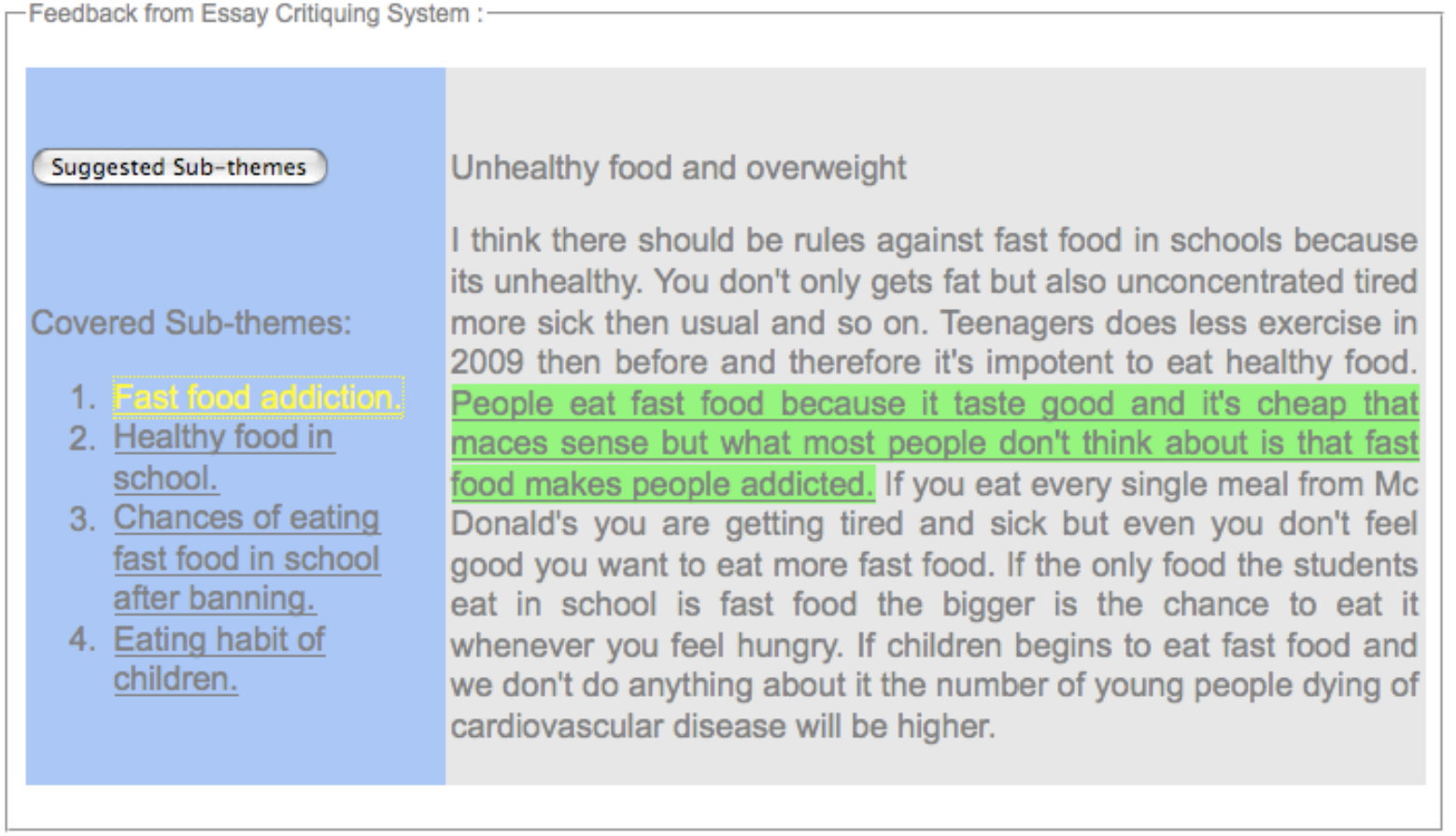
I think there should be rules against fast food in schools because its unhealthy. You don't only gets fat but also unconcentrated tired more sick then usual and so on. Teenagers does less exercise in 2009 then before and therefore it's impotent to eat healthy food. People eat fast food because it taste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

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.

User interface: praise mode

Praise generated by computer



3 week 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 (3 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)

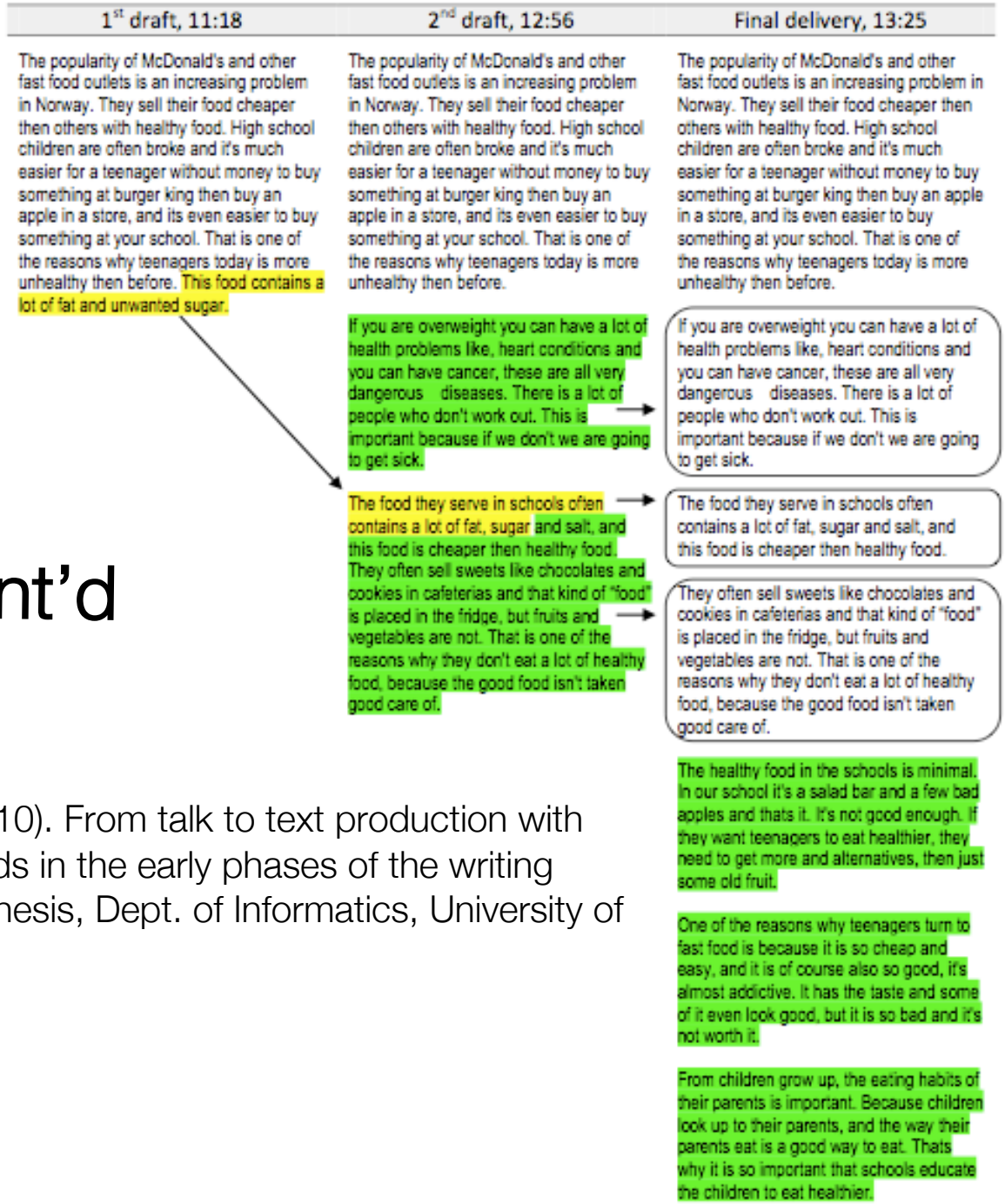
Research methods

- 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)

Tentative 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

Tentative results cont'd



Ref:

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.

Other findings

- Most students found the EssayCritic useful
- They incorporated the critique provided by the system in the next version of their essays, but to varying degree of success (from verbatim copy/ paste to critical reflection during rewrite)
- 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
- Lower achieving students found the critique to motivating, stimulating them to continue working

Limitations

- Many facets of scaffolding can be supported by critiquing, but fading away (a technique commonly used by instructors and parents towards learners) were not
- We do not know if critiquing will have an impact on learning, e.g. if the students who did better in our study will continue to do so without the critic
- Some students brought up relevant topics in writing that was not mentioned by the EC praiser
- Should students be able to “teach the critic,” i.e. To generate new topics to be included in the corpus?

Further work on critiquing

- The scaffolding components of critiquing can be improved, since the range of incorporation of critique by students
- We propose a three-tiered (sociotechnical) structure for scaffolding based on critiquing
  - Technological affordances (as shown here)
  - Pedagogical activities
  - Organizational opportunities
- Three layers of increasingly broader concerns. combining social and technological features

Summary and conclusions

- 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