

Development of a Reading Material Recommender System Based On Design Science Research Approach

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Who are we?



Evren Eryilmaz



Brian Thoms



**Kuo-Hao (Howard)
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Overview

- Motivation and problem identification
- Objective of our software
- Design and development
- Demonstration
- Evaluation
- Conclusion
- Comments & questions



Motivation

- Students majoring in information systems (IS), should not only be technically competent, but also prepared to collaborate effectively in face-to-face and virtual team settings.
- Effective collaboration is an important interpersonal skills for an entry-level software developer' professional growth within an organization.



Problem Identification

- Students from an online course skipped reading 39 percent of all messages in an online discussion to save time Qui and McDougall (2015).
- Peters and Hewitt (2010) showed that 27 percent of students from a large online class avoided reading messages written by some peers altogether, while another 46 percent actively sought messages written by specific peers.

Qiu, M., & McDougall, D. (2015). Influence of group configuration on online discourse reading. *Computers & Education*, 87, 151-165.

Peters, V. L., & Hewitt, J. (2010). An investigation of student practices in asynchronous computer conferencing courses. *Computers & Education*, 54(4), 951-961.



Problem Identification

There are four potential contributors to the conversational overload problem:

- Limited student readiness
- Quantity of information
- Quality of information
- Medium interface



Objective of Our Software

Reduce students' counterproductive conversational overload coping strategies in large annotation based literature discussions.



Design

- Collaborative Filtering
- Content-based Filtering
- Knowledge-based filtering
- Hybrid approaches



Collaborative Filtering Similarity Metrics

- Pearson correlation coefficient (PCC)
- Cosine Similarity
- Constrained PCC



CSCL Environment

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Annotate



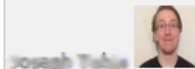
Logout

Annotation Recommendations



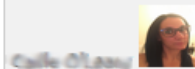
highlighted:

By accessing external PHRs through cloud services, HealthATM provides a starting point for patient-centered health behavior through which one can obtain a sense of control over their health information and health services.



highlighted:

During Phase I, it was identified that providing patients with coupon incentives could promote compliance of healthcare treatments. Consequently, HealthATM incorporated incentives for patients through the Health Incentive Plan (HiP). Through HiP, patients receive points for specific HealthATM tasks, to increase motivation. Tasks such as taking their medication on time and meeting scheduled appointments earned points. Progress across HiP was shown through a visual dashboard. Patients could then redeem points for gift cards



highlighted:

As a web application, HealthATM utilizes HTML and CSS for the user interface and PHP and MySQL for data processing and storage. HealthATM uses a cloud computing architecture and

health status instrument for measuring mental and physical performance and overall health-related quality of life.²³

Patient Activation Measure (PAM) was used to assess patient engagement and activation, which relates to the degree in which a patient is willing to take increased steps toward managing his or her own care. Subjective assessment of overall system usability was conducted through use of the Systems Usability Scale.

Results

Prototype Development and Testing

HealthATM V1.0 architecture. As a web application, HealthATM utilizes HTML and CSS for the user interface and PHP and MySQL for data processing and storage. HealthATM uses a "cloud computing" architecture and integrates with third-party systems. During the pilot, HealthATM was integrated with the Google Health program, Google Calendar calendaring application, and Google Data API protocol, chosen for flexibility, scalability, security, and adherence to health information standards.⁵³⁵

Leveraging health cyberinfrastructures, HealthATM provides community clinics with instant access to patient activity and patient information³⁶ on. Similar to how automated teller machines (ATMs) facilitate financial transactions, the HealthATM architecture provides a transaction-based device for managing health-related information. Just as an ATM from Bank A provides basic financial services for

rewards, which includes rewards for meeting health objectives.²⁸

Although initially designed for touch-screen kiosk hardware, HealthATM can be accessed through any Internet-connected web browser. Particularly for a population where Internet use was low (57% of participants had no e-mail account), creating a user interface with large recognizable graphics and bold fonts was important and eliminated the need for excessive mouse clicks or typing. To further support this touch-screen approach, kiosks were placed in the waiting rooms of three clinic sites easily accessible to patients.²⁴⁰⁶

Health incentive plan. During Phase I, it was identified that providing patients with "coupon" incentives could promote compliance of healthcare treatments. Consequently, HealthATM incorporated incentives for patients through the Health Incentive Plan (HiP). Through HiP, patients receive points for specific HealthATM tasks, to increase motivation. Tasks such as taking their medication on time and meeting scheduled appointments earned points. Progress across HiP was shown through a visual dashboard. Patients could then redeem points for gift cards.²⁷

HealthATM Field Trial Results

Field testing resulted in 144 evaluations, 115 of which completed the evaluation in its entirety. Of the population, 68% were female, 32% were male, and the majority

Eryilmaz, E., Thoms, B., & Canelon, J. (2018). How Design Science Research Helps Improve Learning Efficiency in Online Conversations.

Communications of the Association for Information Systems, 42(1), 21.


Eryilmaz et al., 2019 CSUS-8



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elderly.
☆☆☆☆☆

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Key Idea: More problem solving.

"Gameifying" has been a recent trend in health projects, often seen in the fitness disciplines. Rewarding points and gift cards provide something to work towards to motivate individuals to work through the program, as well as interact with features they might miss their first time through a kiosk. I think the trend has a good reason for existing, seems like a good incentive-reward program, although feasibility through price of the gift cards require attention and tuning to not cost too much for the hospitals/offices.


☆☆☆☆☆

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Statement: Gamification is definitely something that has been effective for fitness disciplines but one thing I've noticed in these apps is the line between professionalism and playful can be skewed at times. Given this is related to medical care, maintaining a cert

<https://tophat.com/blog/gamified-learning/>

☆☆☆☆☆

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Statement: Incentives for Benefits

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HealthATM Field Trial Results

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 **Key Idea:** More problem solving.
Average Rating: 5
☆☆☆☆☆

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Eryilmaz et al., 2019 CSUS-9



Demonstration

Experiment 1: Is there any difference in the predictive accuracy and perceived usefulness of the developed recommendation functionalities?

Experiment 2: Does the recommender system with the highest predictive accuracy and perceived usefulness decrease students' conversational overload coping strategies in online collaborative literature processing?



Evaluation-Predictive Accuracy

Recommender System

Root Mean Squared Error

Cosine Similarity

1.73

Pearson Correlation
Coefficient

1.21

Constrained Pearson
Correlation Coefficient

0.87



Evaluation-Perceived Usefulness

Q1: The recommendations were exactly what I was looking for

Recommender System	Average	Standard Deviation
Cosine Similarity	3.62	0.36
Pearson Correlation Coefficient	4.06	0.60
Constrained Pearson Correlation Coefficient	4.44	0.38

$$F(2,99) = 12.90, p < 0.001^{***}$$



Evaluation-Perceived Usefulness

Q1: The recommendations were exactly what I was looking for

Comparison pair	Tukey HSD Q statistic	Tukey HSD p-value
Cosine Similarity vs Pearson Correlation Coefficient	3.85	0.02*
Cosine Similarity vs Constrained Pearson Correlation Coefficient	3.33	0.05*
Pearson Correlation Coefficient vs Constrained Pearson Correlation Coefficient	7.18	0.001**



Evaluation-Perceived Usefulness

Q2: I was surprised by the recommendations

Recommendation Functionality	Average	Standard Deviation
Cosine Similarity	4.09	0.45
Pearson Correlation Coefficient	4.24	0.43
Constrained Pearson Correlation Coefficient	4.35	0.42

$$F(2,99) = 1.39, p = 0.25$$



Evaluation-Perceived Usefulness

Q3: The recommendations helped me to read instructional materials more effectively

Recommendation Functionality	Average	Standard Deviation
Cosine Similarity	4.15	0.49
Pearson Correlation Coefficient	4.29	0.46
Constrained Pearson Correlation Coefficient	4.38	0.31

$$F(2,99) = 1.15, p = 0.32$$



Evaluation-Perceived Usefulness

Q4: The recommendations prompted me to read postings on the forum

Recommendation Functionality	Average	Standard Deviation
Cosine Similarity	3.73	0.69
Pearson Correlation Coefficient	4.18	0.51
Constrained Pearson Correlation Coefficient	4.59	0.37

$$F(2,99) = 11.82, p < 0.001^{***}$$



Evaluation-Perceived Usefulness

Q4: The recommendations prompted me to read postings on the forum

Comparison pair	Tukey HSD Q statistic	Tukey HSD p-value
Cosine Similarity vs Pearson Correlation Coefficient	3.56	0.04*
Cosine Similarity vs Constrained Pearson Correlation Coefficient	6.88	0.001**
Pearson Correlation Coefficient vs Constrained Pearson Correlation Coefficient	3.32	0.05*



Evaluation-Perceived Usefulness

Q5: The recommendations prompted me to write on the forum

Recommendation Functionality	Average	Standard Deviation
Cosine Similarity	3.89	0.59
Pearson Correlation Coefficient	4.09	0.26
Constrained Pearson Correlation Coefficient	4.26	0.20

$$F(2,99) = 3.53, p = 0.03^*$$



Evaluation-Perceived Usefulness

Q5: The recommendations prompted me to write on the forum

Comparison pair	Tukey HSD Q statistic	Tukey HSD p-value
Cosine Similarity vs Pearson Correlation Coefficient	2.02	0.33
Cosine Similarity vs Constrained Pearson Correlation Coefficient	3.76	0.02*
Pearson Correlation Coefficient vs Constrained Pearson Correlation Coefficient	1.73	0.44



Evaluation-Conversation Overload Coping Strategies

Q1: In an average week, what percentage of the week's messages do you read?

	Control Software	Constrained Pearson Correlation Coefficient		
Choices	%	%	Z	P
0-20%	0.24	0.03	2.51	0.01**
21-40%	0.15	0.12	0.36	0.72
41-60%	0.24	0.18	0.60	0.55
61-80%	0.24	0.50	-2.26	0.02*
81-100%	0.15	0.18	-0.33	0.74



Evaluation-Conversation Overload

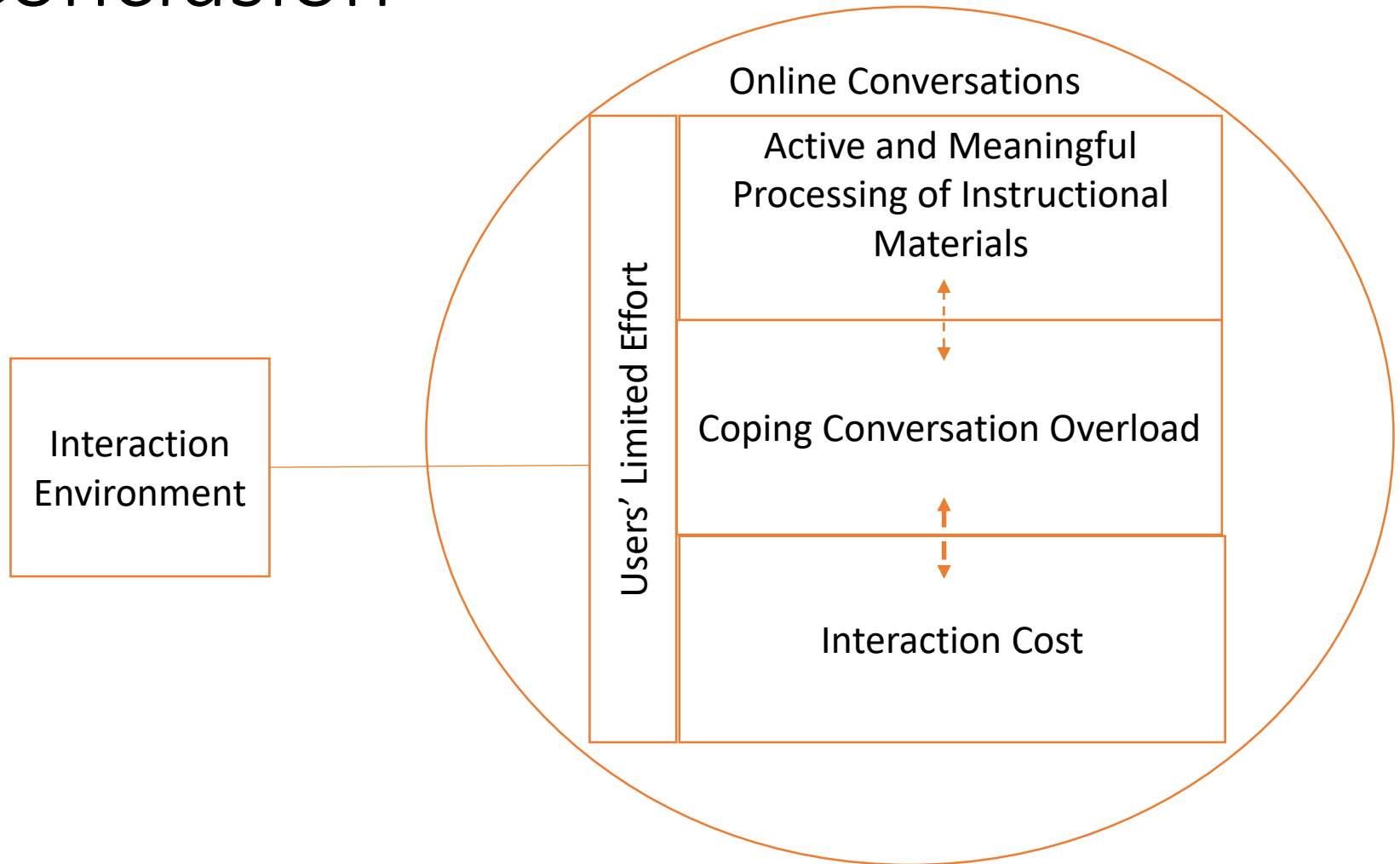
Coping Strategies

Q2: Of the notes you open, approximately, what percentage of notes do you skim quickly or not read the end?

	Control Software	Constrained Pearson Correlation Coefficient		
Choices	%	%	Z	P
0-20%	0.03	0.32	-3.18	0.001***
21-40%	0.19	0.18	0.31	0.76
41-60%	0.41	0.18	2.13	0.03*
61-80%	0.06	0.23	-2.05	0.04*
81-100%	0.31	0.09	4.66	0.03*



Conclusion



Thank You for Your Time

Your Comments and Questions are welcomed.

Please address feedback to:
evren.eryilmaz@csus.edu

