

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

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Overview

- Motivation and problem identification
- Objective of my software
- Design and development
- Demonstration
- Evaluation
- Communication
- Comments & questions



Motivation

- Collaboration between software developers and business users can be instrumental to the success of software development projects.
- Effective collaboration is an important interpersonal skills for an entry-level software developer' professional growth within an organization (Aasheim et al., 2009).
- Asynchronous online discussion can facilitate a natural setting for collaboration in virtual teams.

Aasheim, C. L., Li, L., & Williams, S. (2009). Knowledge and skill requirements for entry-level information technology workers: A comparison of industry and academia. *Journal of Information Systems Education*, 20(3), 349-356.



Problem Identification

Many students perceive online discussions more confusing compared to face-to-face discussions because

 They feel being overwhelmed by a large number of messages

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



 Draw asynchronous online discussion participants' attention to the most important parts of overwhelmingly large discussions.

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





A recommendation functionality with high predictive accuracy and perceived usefulness



Design

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

Abel, F., Bittencourt, I. I., Costa, E., Henze, N., Krause, D., & Vassileva, J. (2010). Recommendations in online discussion forums for e-learning systems. *IEEE transactions on learning technologies*, *3*(2), 165-176.



Design

- Students' interests change over time depending on their level of understanding of a subject
- 2. The system needs to generate precise recommendations with a small amount of input



Cosine Similarity

$$\frac{Sim(a,b)}{||\vec{r}_{a}|| \, ||\vec{r}_{b}||} = \frac{\sum_{p} r_{a,p} r_{b,p}}{\sqrt{\sum_{p} r^{2}_{a,p}} \sqrt{\sum_{p} r^{2}_{b,p}}}$$

a,b: students $r_{a,p}$: rating of student a for message p



Pearson Correlation Coefficient

$$sim(a,b) = \sum_{p \in I} (r_{a,p} - \overline{r}_a) (r_{b,p} - \overline{r}_b)$$

$$\sqrt{\sum_{p \in I} (r_{a,p} - \overline{r}_a)^2} \sqrt{\sum_{p \in I} (r_{b,p} - \overline{r}_b)^2}$$

a,b: students $r_{a,p}$: rating of student a for message p I: set of messages, rated both by a and b



Constrained Pearson Correlation Coefficient

$$sim(a,b) = \sum_{p \in I} (r_{a,p} - r_{med})(r_{b,p} - r_{med})$$

$$\sqrt{\sum_{p \in I} (r_{a,p} - r_{med})^2} \quad \sqrt{\sum_{p \in I} (r_{b,p} - r_{med})^2}$$



$$Pred(a,p) = \overline{r}_{a} + \sum_{b \in N} sim(a,b)(r_{b,p} - \overline{r}_{b})$$
$$\sum_{b \in N} |sim(a,b)|$$

Schafer, J. B., Frankowski, D., Herlocker, J., & Sen, S. (2007). Collaborative filtering recommender systems. In *The adaptive web* (pp. 291-324). Springer, Berlin, Heidelberg.



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Annotation Recommendations



. 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.

loseph Takan 🗛 highlighted:

During Phase I, it was identified

that providing patients with coupon incentives could promote compliance of healthcare treatments. 25 Consequently, HealthATM incorporated incentives for patients through the Health Incentive Plan (HiP). Through HiP, patients receive points for specif?c 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



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

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

Patient Activation Measure (PAM) ² 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. ²¹ Subjective assessment of overall system usability was conducted through use of the Systems Usability <u>Scale.</u>²¹

<u>Results</u>

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.⁵²
Buring 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 informati³⁶ 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

Annotate

Logout

objectives.²⁸

≅ The

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

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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. (Accepted). How Design Science Research Helps Improving Learning Efficiency in Online Conversations. Communications of the Association of Information Systems.



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elderly.	
27	<u>Reply</u>
Key Idea: More problem solving.	
"Gameifying" has been a recent trend in health projects,	
often seen in the fitness disciplines. Rewarding points an	d
gift cards provide something to work towards to motivate	
individuals to work through the program, as well as inter	act
with features they might miss their first time through a ki	iosk.
I think the trend has a good reason for existing, seems li	ke 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.

Statement: Incentives for Depeti



Reply

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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Demonstration

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



Evaluation-Predictive Accuracy

$$\sqrt{\frac{1}{n}\sum_{u,i}(p_{u,i}-r_{u,i})^2}$$

Recommendation Functionality	Root Mean Squared Error
Cosine Similarity	1.73
Pearson Correlation Coefficient	1.21
Constrained Pearson Correlation Coefficient	0.87



Q1: The recommendations were exactly what I was looking for

Recommendation Functionality	Average	Standard Deviation
Cosine Similarity	3.62	0.78
Pearson Correlation Coefficient	4.06	0.60
Constrained Pearson Correlation Coefficient	4.44	0.61

F(2,99) = 12.90, p < 0.001***



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**



Q2: I was surprised by the recommendations

Recommendation Functionality	Average	Standard Deviation
Cosine Similarity	4.09	0.65
Pearson Correlation Coefficient	4.23	0.67
Constrained Pearson Correlation Coefficient	4.35	0.64



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

Recommendation Functionality	Average	Standard Deviation
Cosine Similarity	4.15	0.68
Pearson Correlation Coefficient	4.29	0.70
Constrained Pearson Correlation Coefficient	4.38	0.55



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

Recommendation Functionality	Average	Standard Deviation
Cosine Similarity	4.15	0.71
Pearson Correlation Coefficient	4.29	0.82
Constrained Pearson Correlation Coefficient	4.38	0.61

F(2,99) = 11.82, p < 0.001***



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*



Q5: The recommendations prompted me to write on the forum

Recommendation Functionality	Average	Standard Deviation
Cosine Similarity	3.89	0.76
Pearson Correlation Coefficient	4.09	0.51
Constrained Pearson Correlation Coefficient	4.25	0.45

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



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	%	%	X ²	Р
0-20%	0.15	0.09	0.56	0.45
21-40%	0.35	0.12	5.23	0.02*
41-60%	0.32	0.12	4.19	0.04*
61-80%	0.15	0.5	9.68	0.002**
81-100%	0.03	0.18	3.99	0.05*







Thank You for Your Time

Your Comments and Questions are welcomed.

Have a great spring break!



