



Design of Dashboard Through Learning Analytics Facilitating Learners Discussion Activities in e-Learning Environments

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Table of Contents

- I. Introduction**
- II. Online discussion and Learning Analytics Dashboard**
- III. Visualization of Online Discussion**
- IV. Dashboard Design Directions**
- V. Prototype of Dashboard**
- VI. Conclusion**

This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2015S1A5A2A03048269)

This study is a revision of Yoo (2017) 's doctoral dissertation.



I. Introduction

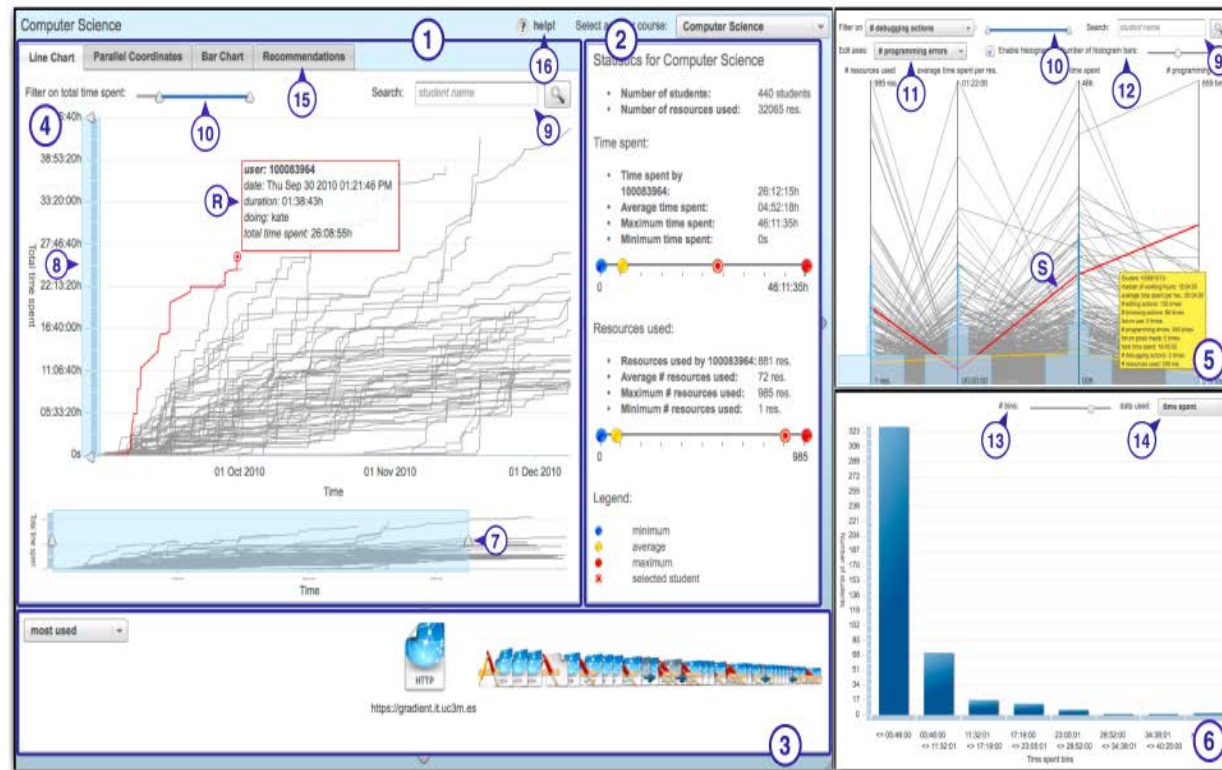
1. Needs of Research

- Promote intuitive understanding of discussion activities by providing visualization of information about online discussion activities
- Limitations of visual representation of online discussion activities in the previous research
 - Focus on Big Data Analysis or Visualization Techniques
 - More or less information that is difficult for learners to understand (Riphagen, 2013)

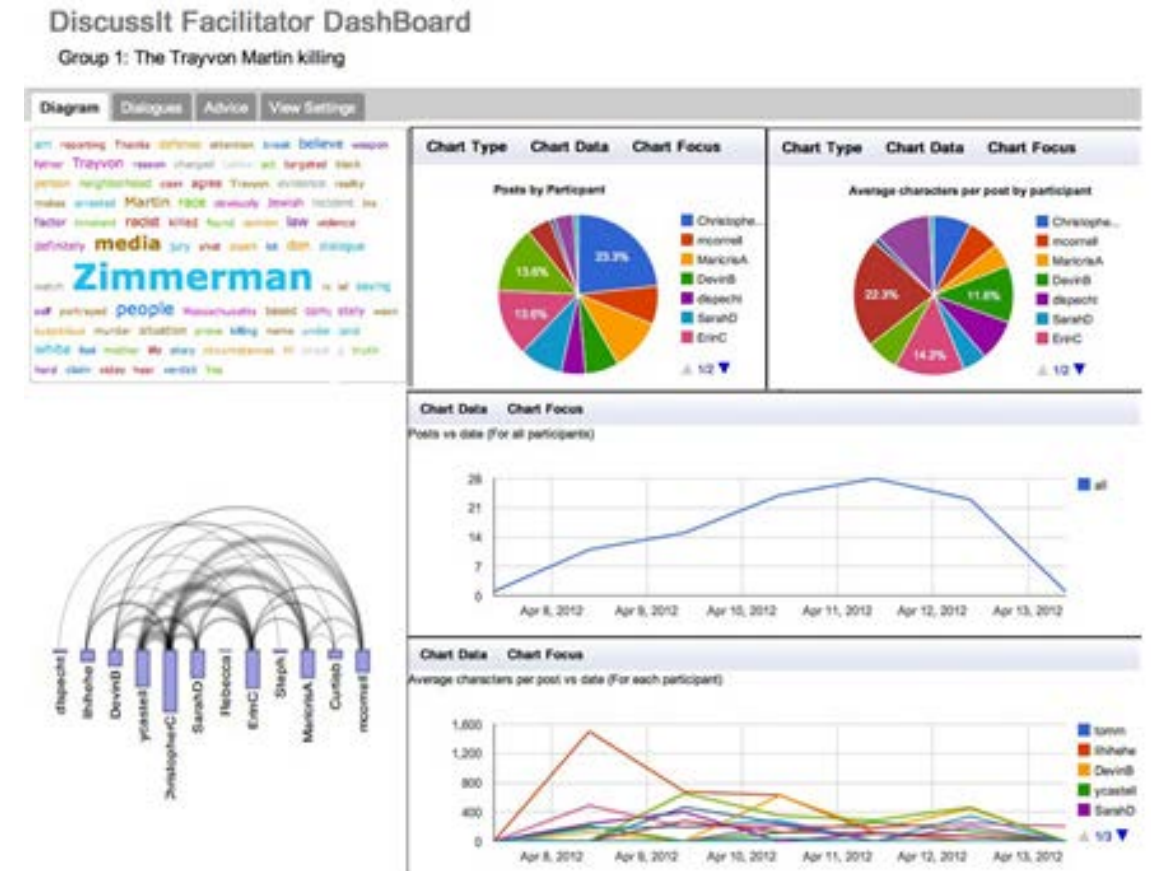
2. Purpose of Research

- To develop a dashboard prototype for online discussion activities in accordance with the design directions derived from the analysis of previous research.

I. Introduction



Govaerts, Verbert, Duval, & Pardo (2012)



Murray, Wing, Woolf, Wise, Wu, Clark, Osterweil, & Xu (2013)



II. Online discussion and Learning Analytics Dashboard

1. Online discussion

- interactions in which learners exchange text-based messages in many-to-many formats in virtual space (Rapport, 1991)
- interactive activities based on various interactive tools available on the Web (Lim, 1999)

2. Learning analytics

- an emerging field in which sophisticated analytic tools are used to improve learning and education (Elias, 2011)
- the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs (Long & Siemens, 2011)

II. Online discussion and Learning Analytics Dashboard

3. Learning Analytics Dashboard

- Dashboard
 - “a visual display of the most important information needed to achieve one or more objectives; consolidated and arranged on a single screen so the information can be monitored at a glance” (Few, 2006)
- Learning Analytics Dashboard
 - a newly developed learning support tool for virtual classrooms that is believed to allow students to review their online learning behavior patterns intuitively through the provision of visual information (Kim, Jo & Park, 2015)





II. Online discussion and Learning Analytics Dashboard

4. Effects of Learning Analytics Dashboard

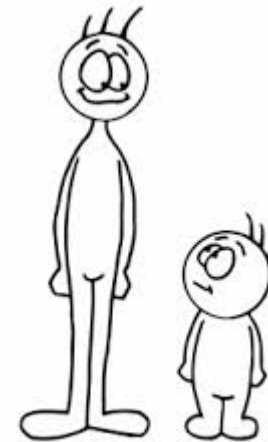
1) Awareness Information

- Awareness information in collaborative online environments plays a role as making one's activity visible to others (Dourish, 1997).
- Group Awareness gives an overview of group members' roles, activities, movements and status in the collaborative process (Greenberg, Gutwin, Cockburn, 1996)
- Objective self-awareness means the process of taking oneself as the focus of one's own attention, or becoming aware of oneself (Mullen & Goethals, 1987)
 - if one is sufficiently aware of oneself, one may come to recognize a discrepancy between one's present behavior and the standard of behavior

II. Online discussion and Learning Analytics Dashboard

2) Social Comparison Theory (Festinger, 1954)

- People compare themselves to others because there is no objective yardstick with which to evaluate the self
- Upward Comparison
 - You > Me (You are better)
 - lead to set higher personal goal
- Downward matching
 - Me > You (I feel sorry for you ~)
 - reduce contributions to match the lower standards for performances





III. Visualization of Online Discussion

1. Research Method

1) Literature Search

- Database: Google Scholar, Web of Science (ISI), RIIS
- Search words: 1st - learning analytics, dashboard
2nd - debate, discussion, communication, dialogue
- Total 97 → 25개
 - Design or develop a learning analysis dashboard for online discussion activities
 - Include the purpose, objects, and techniques of visualization

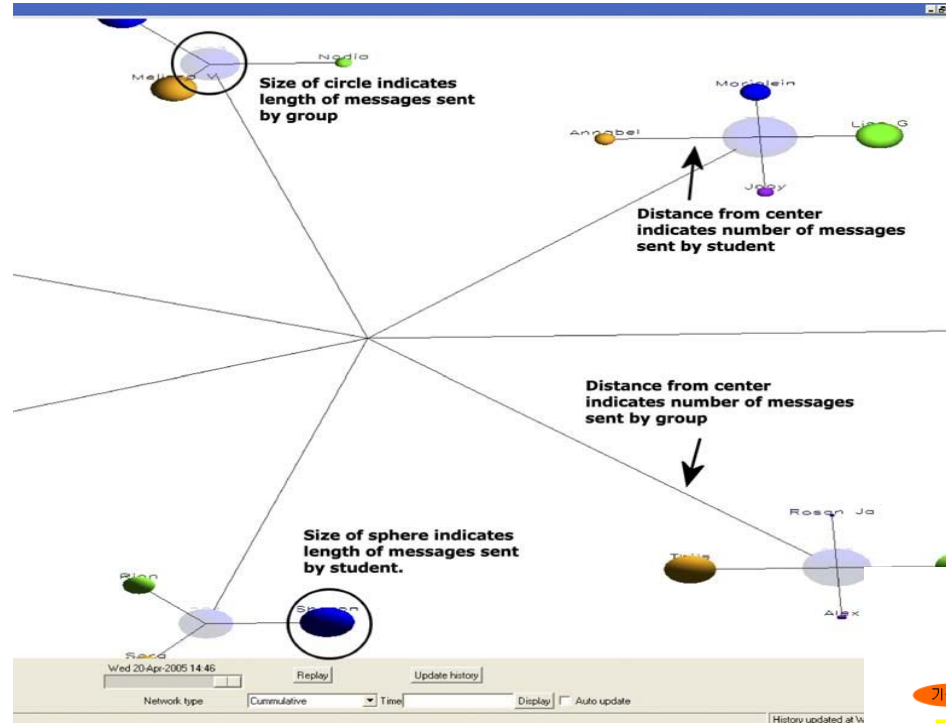
2) Coding Scheme

- Visualization objects : participation, interaction, keywords, message types, opinion relationships
- Visualization techniques: time, distribution, part to whole, comparison, hierarchy, relationship, spatial location, metaphor

III. Visualization of Online Discussion

2. Research Results

Participation



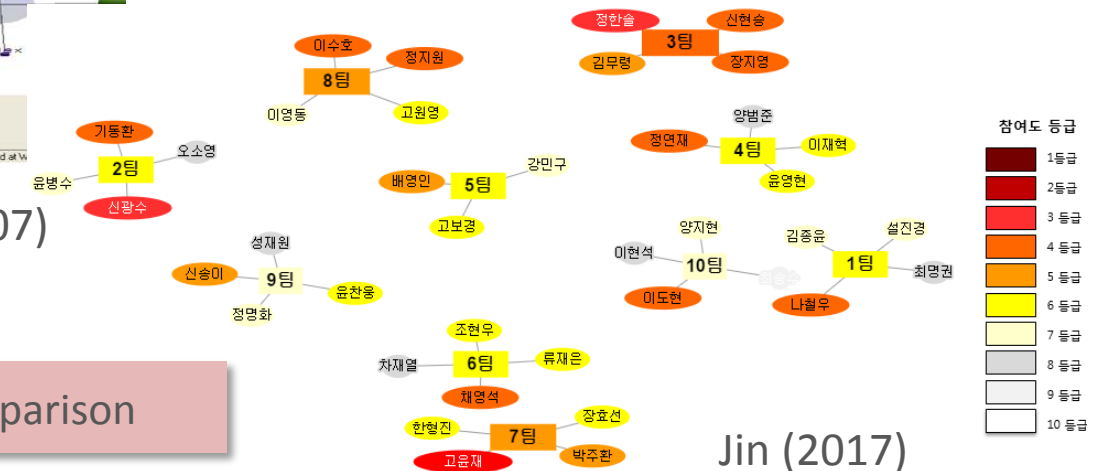
Janssen, Erkens, Kanselaar, & Jaspers (2007)

Metaphor, Comparison

Comparison, Time



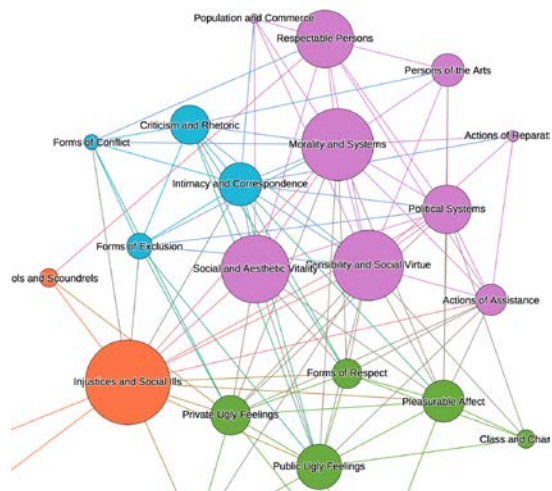
Yoo (2017)



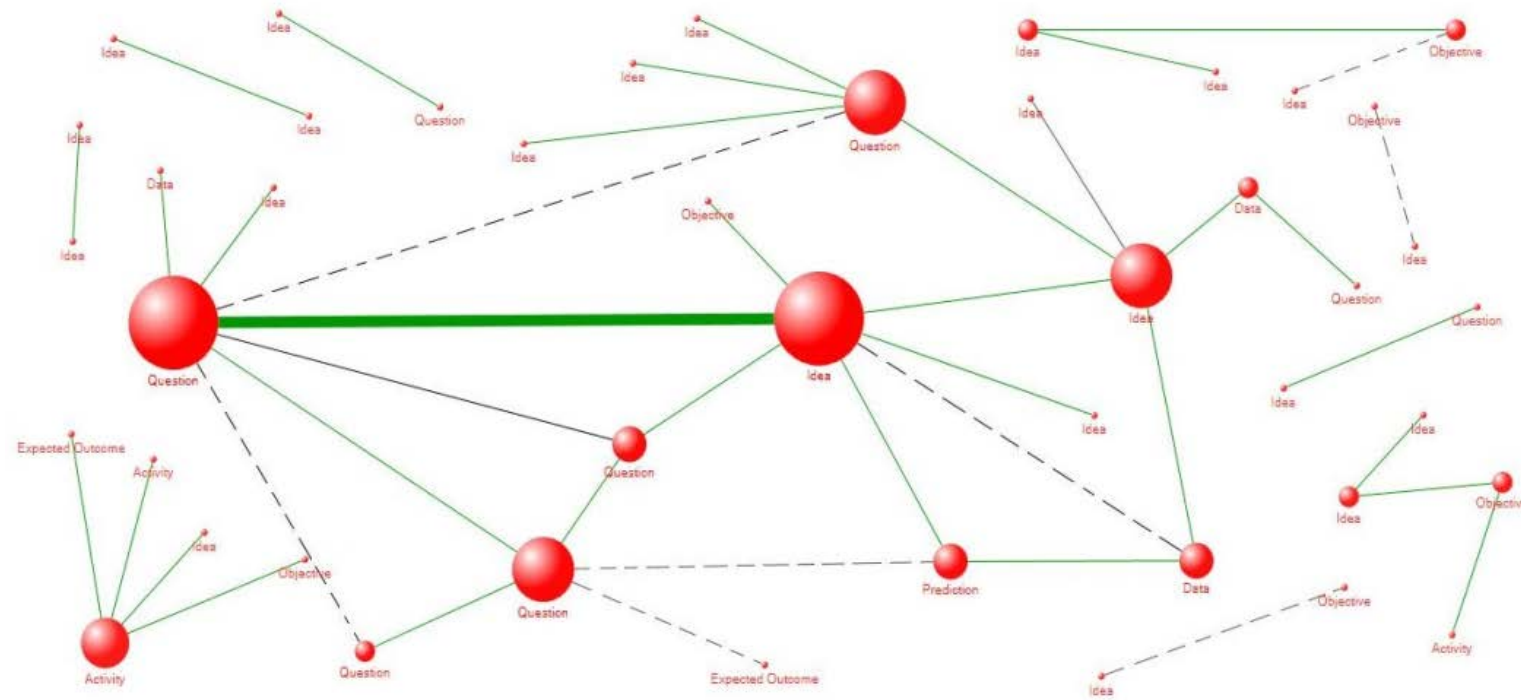
Jin (2017)

III. Visualization of Online Discussion

Interaction



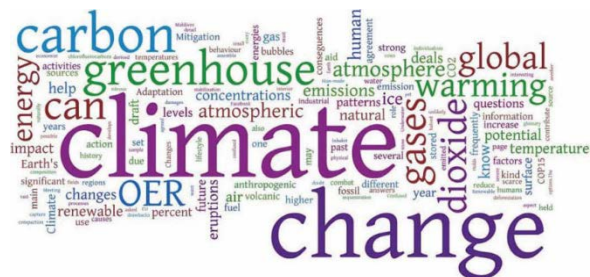
Ryan (2016)



De Liddo, Shum, Quinto, Bachler, & Cannavacciuolo (2011)

Relationship, Comparison, Distribution

Keywords



landoli, Quinto, De Liddo, & Shum (2012)

Message Types



You made **6** contributions to this 30-post discussion, including three important elements of educational discussion: **reasoning**, **evaluation** and **extension**.

You made less use of **challenges**. Positive challenges include phrases such as 'What about', 'although' and 'I'm not sure'.

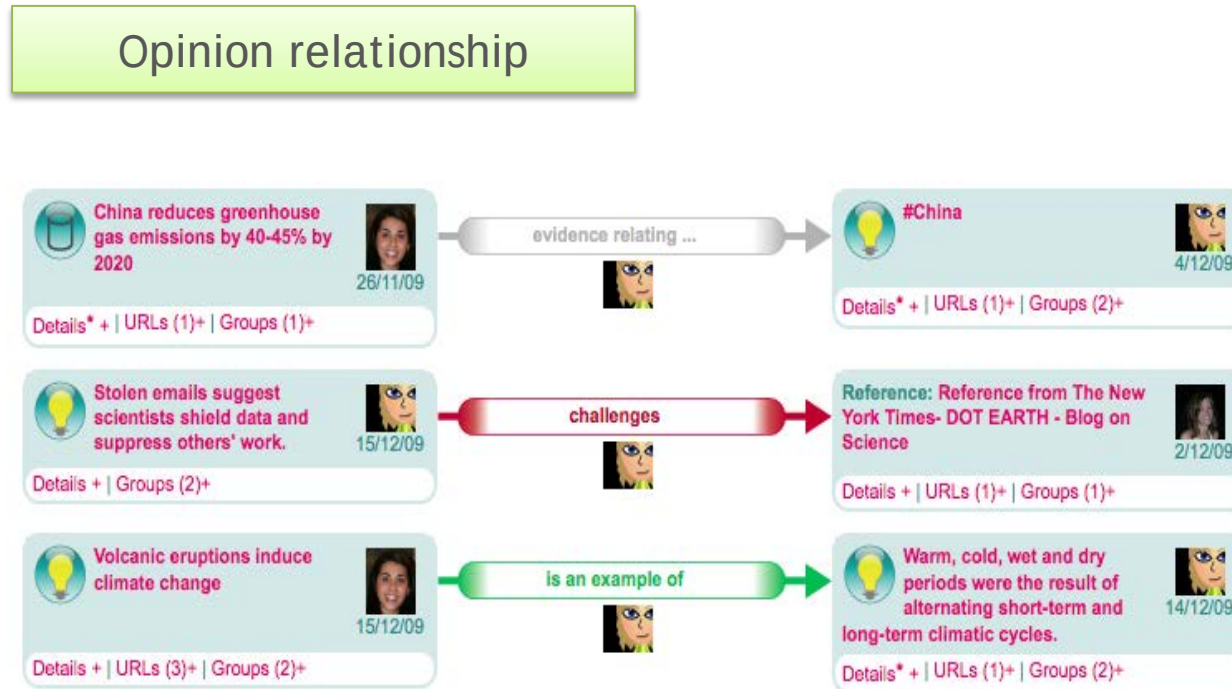
Ferguson & Shum (2012)



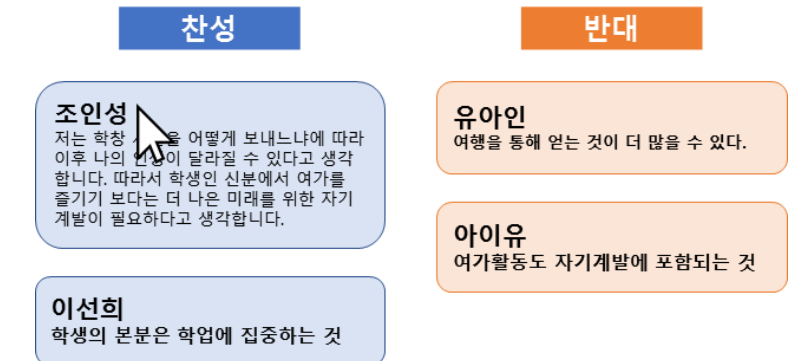
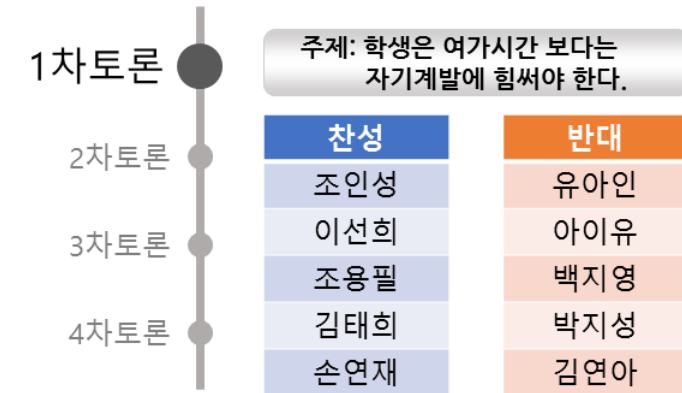
Jo, Lee & Seo (2015)

Time, Metaphor, Comparison, Relationship

III. Visualization of Online Discussion



Ferguson & Shum (2012)



Yoo (2017)

Time, Metaphor, Comparison, Relationship



IV. Dashboard Design Directions

1. General Design Directions

- **The information shown in the visualization** (Erickson & Kellogg, 2003)
 - does not need to be detailed and precise
 - is provided with a general concept for online discussion
- **All learners should see the same visuals** (Erickson, 2003)



IV. Dashboard Design Directions

2. Specific Design Directions

- **Analyze and visualize participation, interaction, keywords, opinion relationships, and message types of online discussion according to purpose**
 - **From the history of past activities to the prediction of future learning activities, visualize the learning activities in the order in which they occur in a continuous flow.**
 - **Visualize easily to distinguish and compare with peer learners' information**
 - **Use Intuitive metaphor**
-



V. Prototype of Dashboard

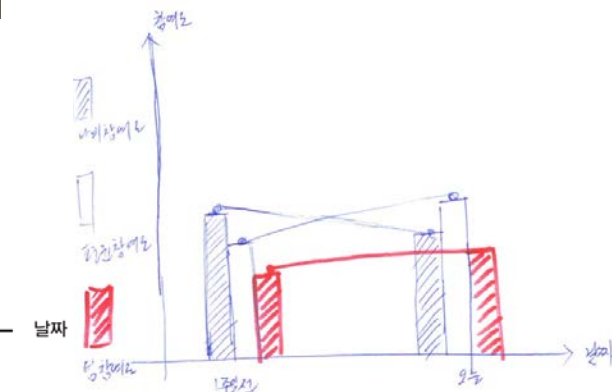
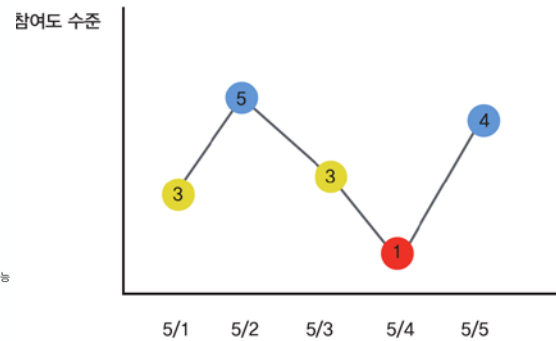
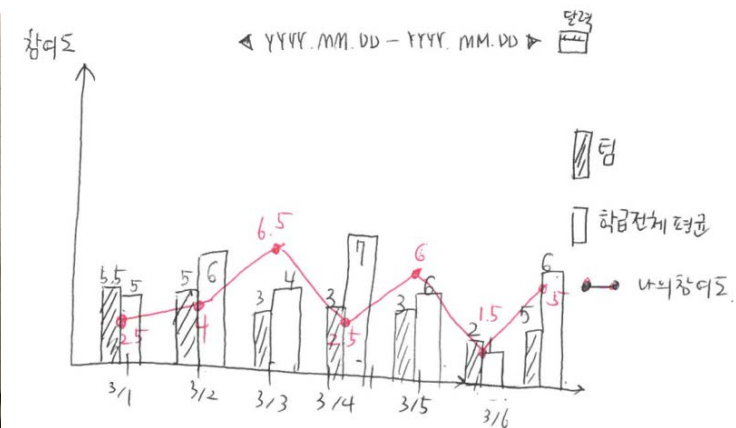
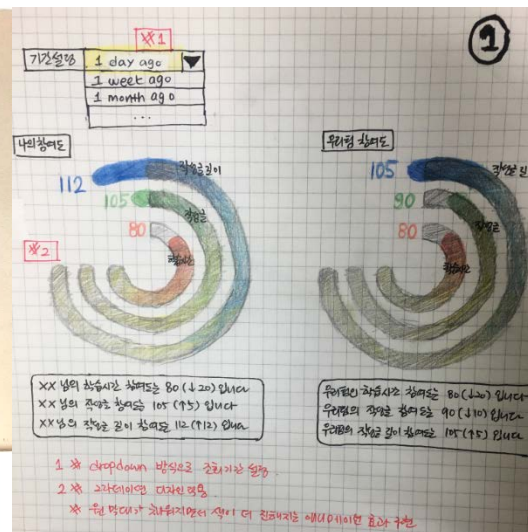
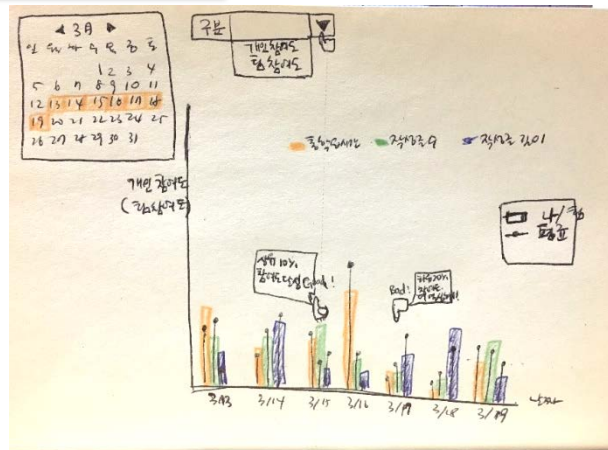
1. Dashboard Design Method

- **Participants: 3 Instructional designers, 2 visual graphic designers, & 1 computer programmer**
- **Method:**
 - Provide scenarios for online discussion learning activities
 - Provide general & specific design directions
 - Request to design a dashboard for participation, interaction, keywords, message types, and opinion relationships of online discussion activities

V. Prototype of Dashboard

2. Dashboard Design Results

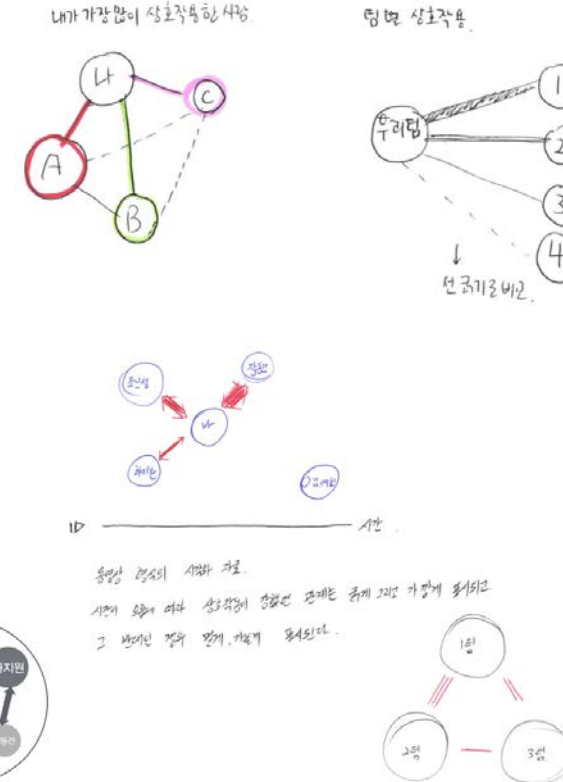
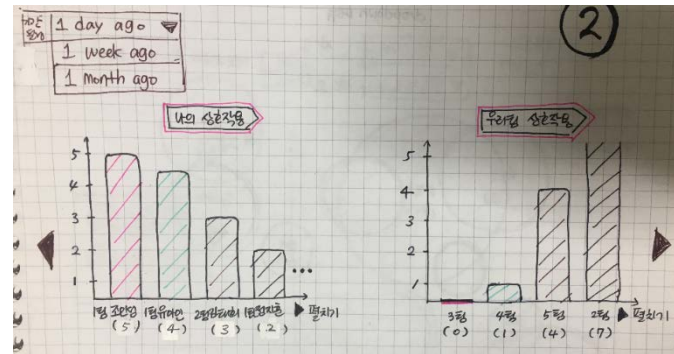
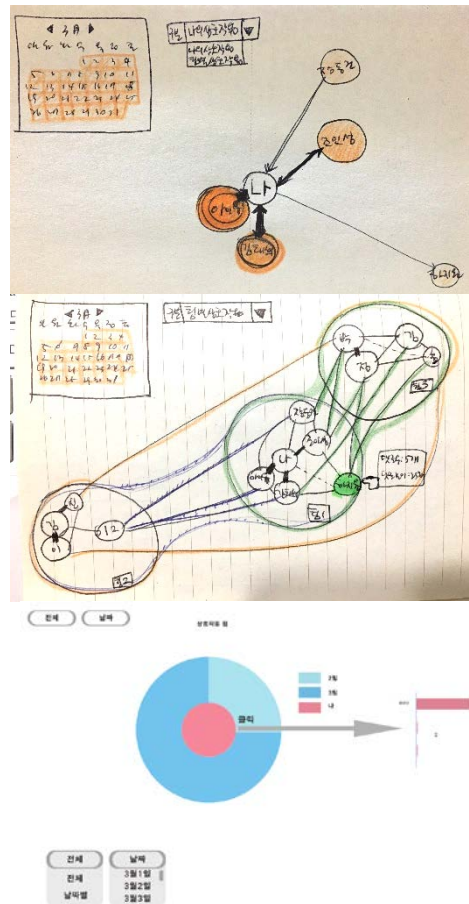
Participation



V. Prototype of Dashboard

2. Dashboard Design Results

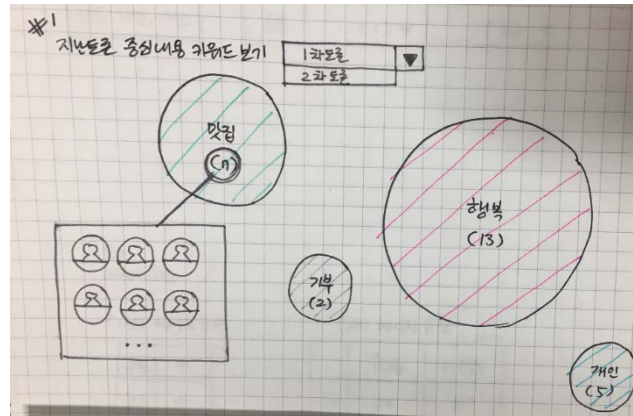
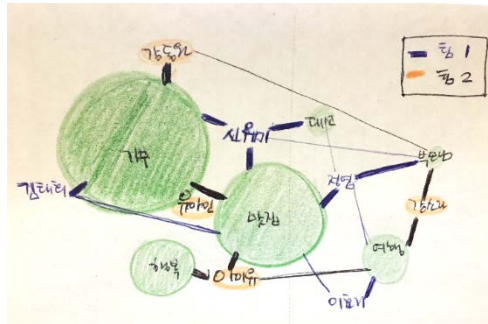
Interaction



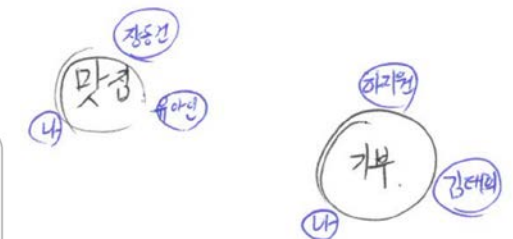
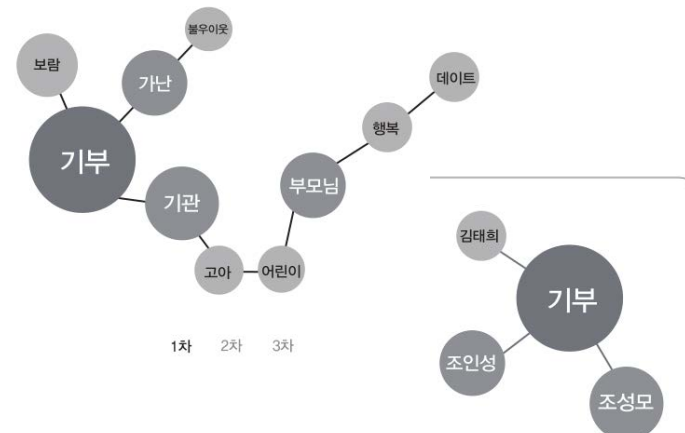
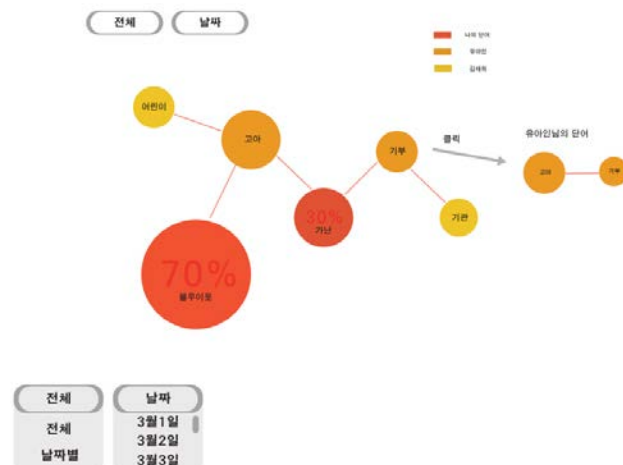
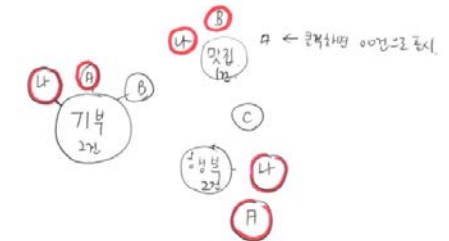
V. Prototype of Dashboard

2. Dashboard Design

keywords



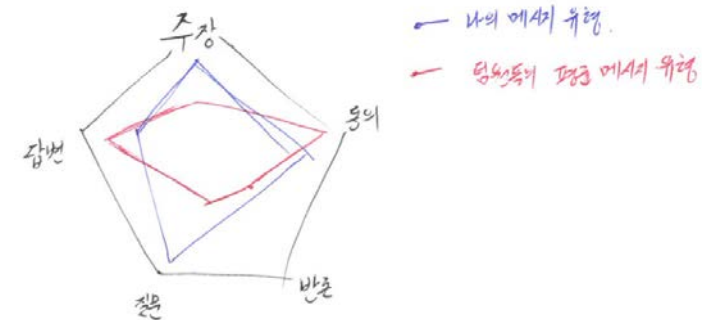
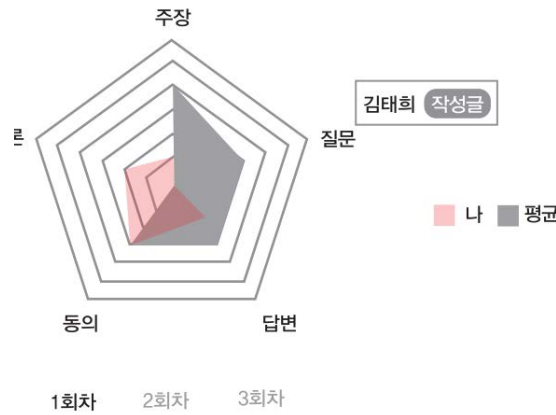
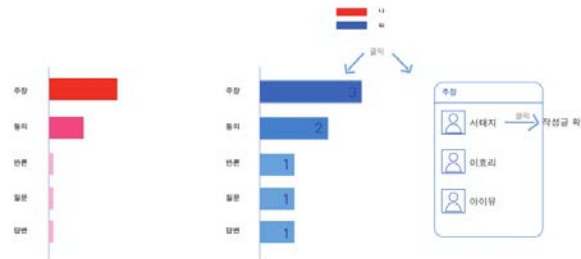
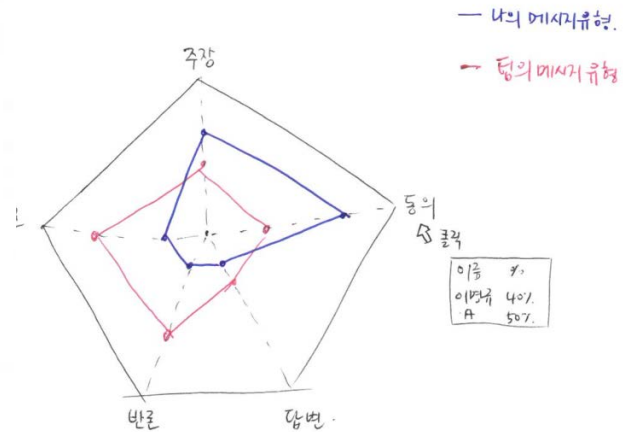
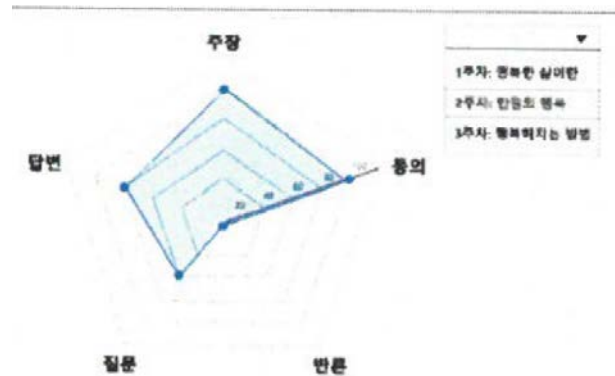
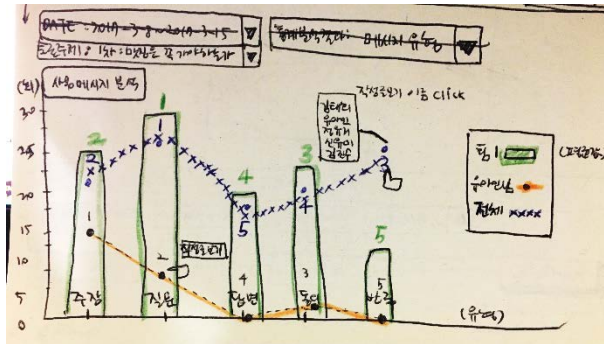
중심단어
1차도론 - 기부, 기부
2차도론 - 개인, 행복
3차도론 - 기부, 행복



V. Prototype of Dashboard

2. Dashboard Design Results

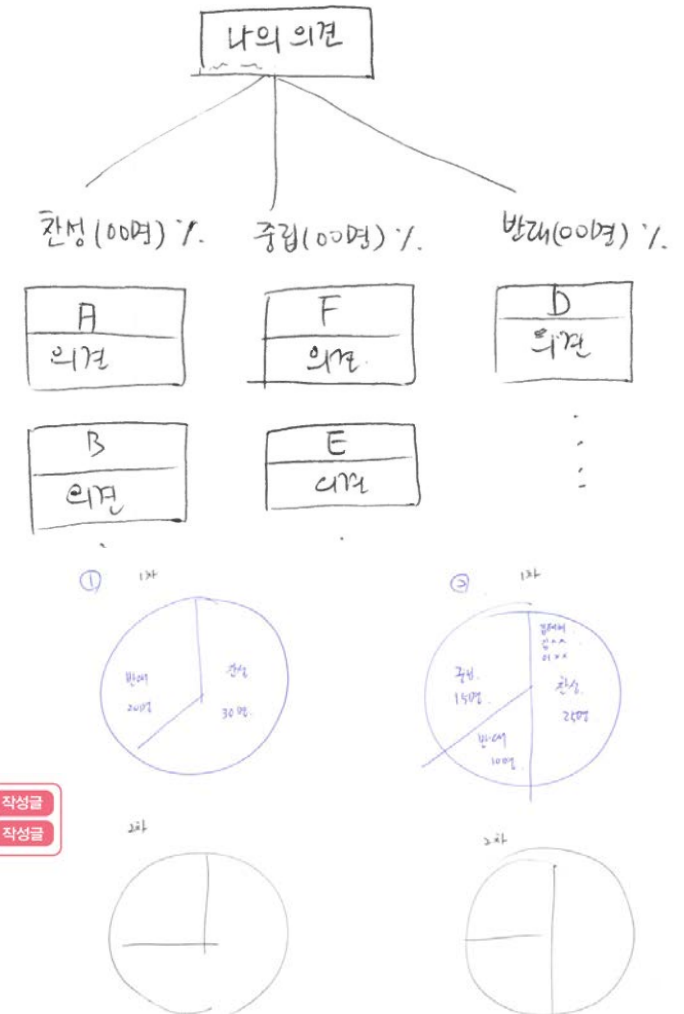
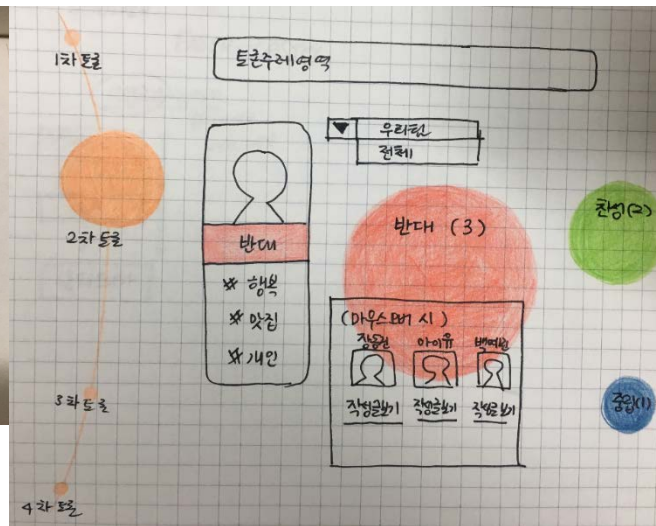
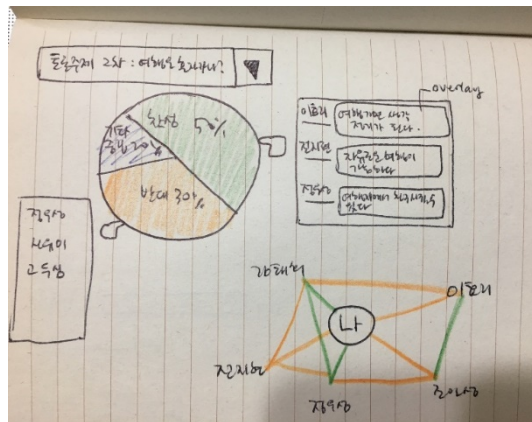
Message types



V. Prototype of Dashboard

2. Dashboard Design Results

Opinion relationships





V. Prototype of Dashboard

3. Prototype Development

- **Method:**

- Review the dashboard design to determine the final dashboard prototype
- Expert Survey
 - Participants: 6 educational technology experts
 - verify whether the selected prototype reflects the design directions

V. Prototype of Dashboard

3. Prototype Development

Participation

Topics ▼

1st : Happy Life

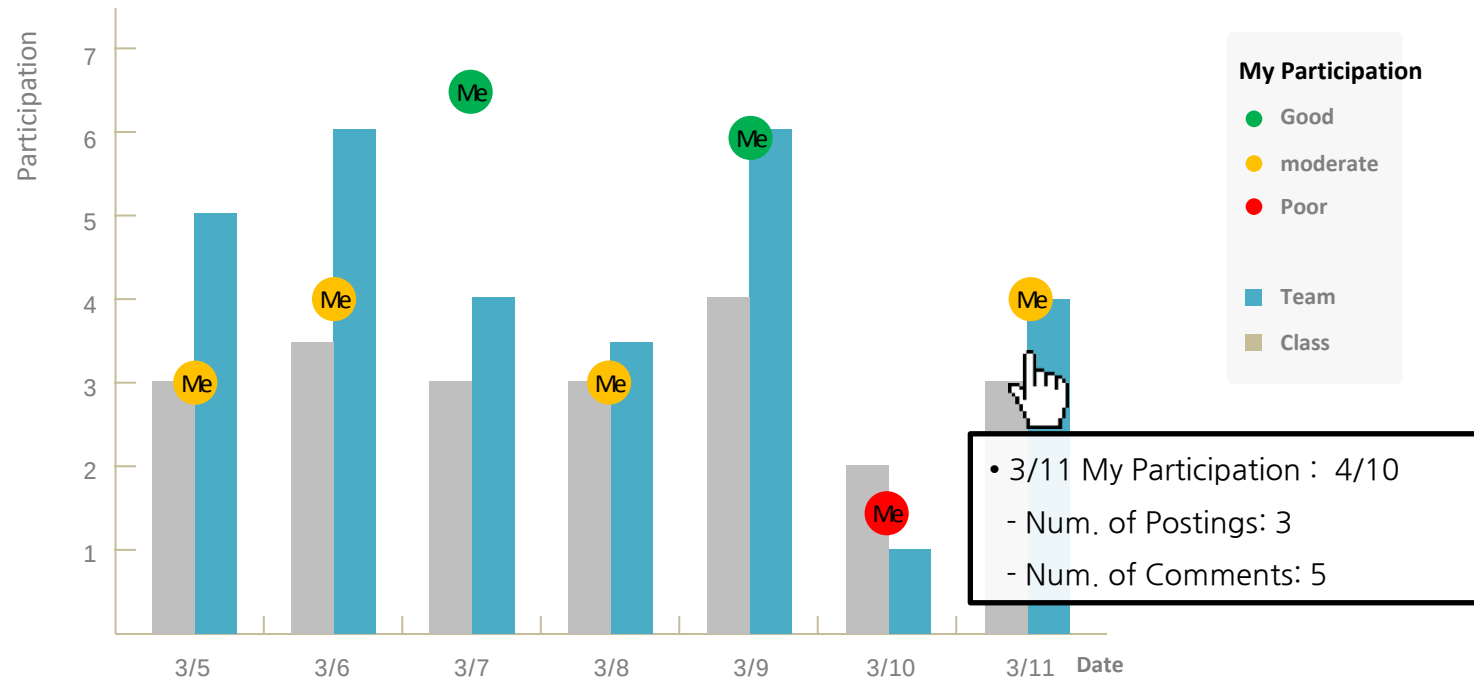
2nd : Happiness of \$10

3rd : How to be happy

일 주 월

2017. 3.

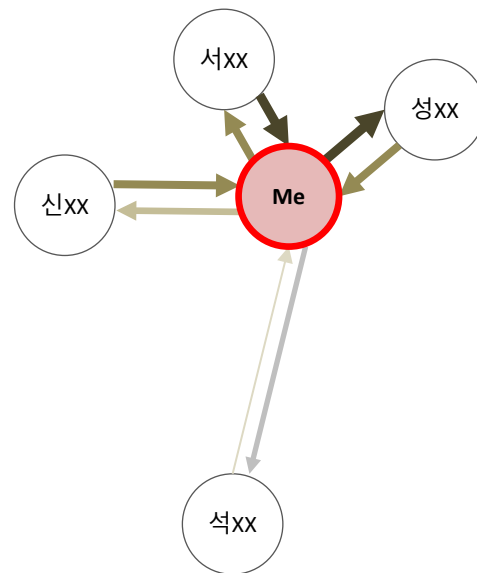
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V. Prototype of Dashboard

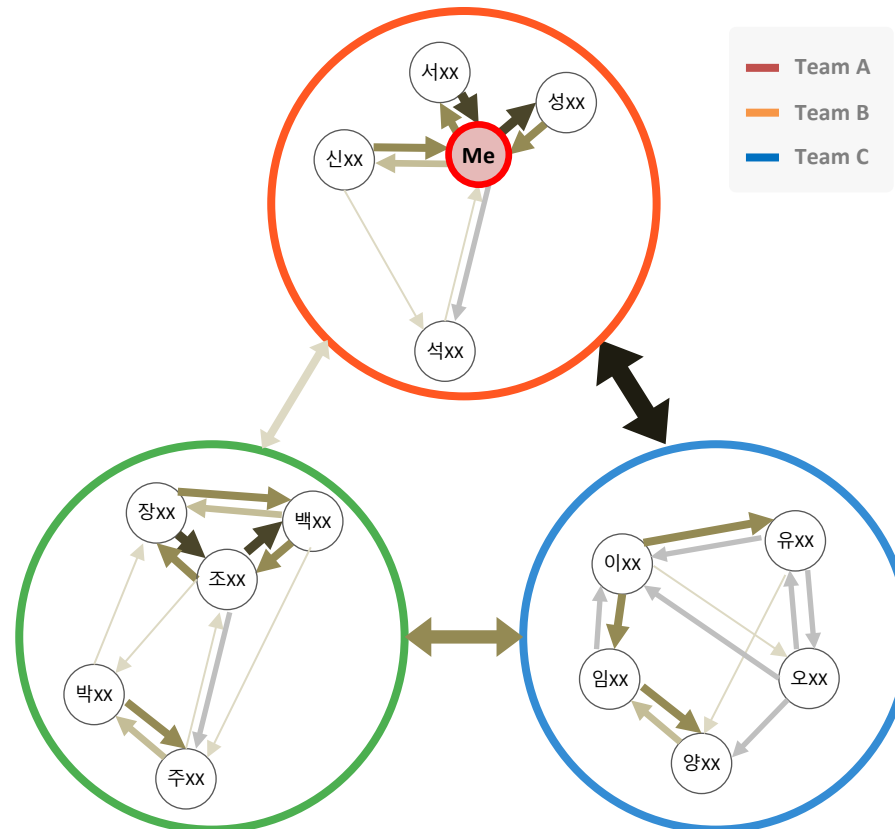
3. Prototype Development

Interaction



Between team members

Between teams



Between team members

Between teams

Topics ▼

1st : Happy Life

2nd : Happiness of \$10

3rd : How to be happy

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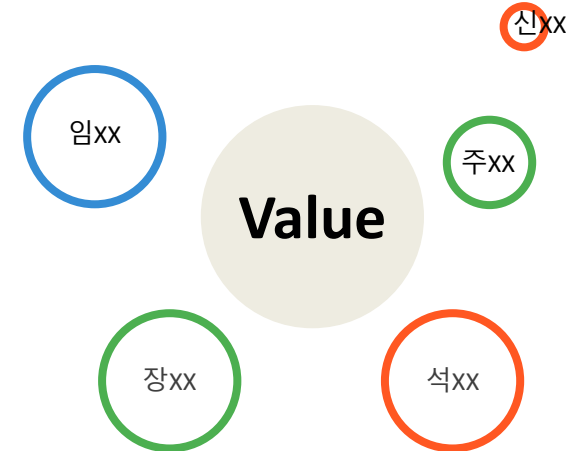
2017. 3.

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.....

keywords

— Team A — Team B — Team C



Topics ▼
1 st : Happy Life
2 nd : Happiness of \$10
3 rd : How to be happy

3rd : How to be happy

일 주 일

2017. 3.

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1 2 3 4

12 13 14 15 16 17 18

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.....

Message types



- 서XX [View](#)
- 석XX [View](#)
- 성XX [View](#)

.....

Opinion relationships



pros

Me

♀XX

0|xx

성XX

장XX

■ Team A
■ Team B
■ Team C

장xx

저는 학창 시절을 어떻게 보내느냐에 따라 이후 나의 인생이 달라질 수 있다고 생각합니다. 따라서 학생인 신분에서 여가를 즐기기 보다는 더 나은 미래를 위한 자기계발이 필요하다고 생각합니다.

장xx

저는 학창 시절을 어떻게 보내느냐에 따라 이후 나의 인생이 달라질 수 있다고 생각합니다. 따라서 학생인 신분에서 여가를 즐기기 보다는 더 나은 미래를 위한 자기계발이 필요하다고 생각합니다.

Topics ▼
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2nd : Happiness of \$10
3 rd : How to be happy

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2017. 3.

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2017. 3.

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2017. 3.

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VI. Conclusion

- **Develop dashboard design prototypes for online discussion activities**
 - 5 visualization objects: participation, interactions, keywords, message types, opinion relationships
 - Design directions through dashboard analysis proposed in previous research
- **Provide feedback on quantitative participation and qualitative discussion contents in online discussion activities → Promoting learner's cognitive participation and social participation**
- **Future research**
 - Develop dashboard prototype and investigate the educational effects

Q & A

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