Knowledge Structure Measurement of Cross-classification Table as a Visual Representation

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ABSTRACT

Knowledge structure (KS) explains how information elements are organized in memory and in our linguistic artifacts (Clariana, 2010). In this exploratory research, we tested the effects of visual representation in comparison to text representation using a sorting task as a KS elicitation method and a comprehension test (10 pre and post test questions). We concluded that the results of KS measurement and comprehension test are paralleled. Also, we found some evidence that Google Ngram network influences one's potential prior knowledge considering the overlap with their pre text and table maps.

BACKGROUND

Visual vs Text

Under Mayer's Cognitive Theory of Multimedia Learning (CTML) as well as multimedia principle, the rationale for computer-based multimedia instruction is that text and visuals can be better than either single representation (Butcher, 2014; Skuballa, Dammert, & Renkl, 2018; Mayer, 2009; Mayer, 2018).

Why Cross classification table?

It is explicitly conveying the structure of information as a form of visual representation, so 'compare and contrast' several different objects with similar attributes and slots. Knowledge represents in frame and those frames subcategorize the knowledge.

Knowledge representation and Knowledge Structure

Measuring knowledge structure (Clariana, 2009) provides an approach to help understand cognitive processing. Frame theory (Minsky, 1974) explains knowledge representation in a structure setting of human and artificial intelligence. To be specific, based on semantic networks(semantic relations between concepts in a network as a form of knowledge representation), knowledge is represented in frames having substructure under certain criteria. This presents how information elements are organized in memory (Clariana, 2010; Kim& Clariana, 2015), so this knowledge structure measurement is a useful construct to visualize mental representation, and this kind of KS measurement can help the needs for the newer measurement that present cognitive processing during multimedia learning (Mayer, 2017). Thus, the goal of the current research is to confirm a study from Clariana (2009) on the use of sorting tasks from measuring KS in text and extend the scope to measure KS with cross classification table.

Google books Ngram viewer

An online search engine that charts the frequencies of any set of strings between 1500 and 2008 in Google's text corpora. We believe Ngram is a potential sample of pre-knowledge because people are influenced by texts which also influences structure of knowledge, so it is reciprocal relationship. Thus, we are making an inference that group data or lessons may have the similar structure from this google ngram viewer(Clariana,2019).

OBJECTIVES & RESEARCH QUESTIONS

To confirm a study from Clariana (2009) on the use of sorting tasks in text to measure KS and further extend the scope to measure KS to visual representation by cross classification table, so we compared the results from the comprehension test(MC test) and KS test. Also, we want to test google ngram to see the effect of knowledge clouds on people's prior knowledge.

Q1. Do the results of two different measurements show some correlation?

Q2. What were the differences between table and text in both measurements ?

Q3. Do Post test outcomes were better than the pre test outcomes in both setting? Do the treatment effects differ in table and text?

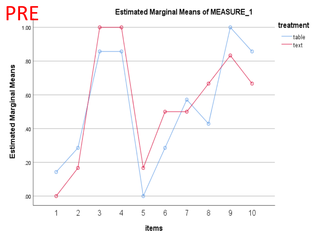
Q4. Can we find the idea that google Ngram influences one's potential prior knowledge?

FINDINGS

Comprehension test measurement

- Mean of each question in Pre and Post tests by text and table

PRE

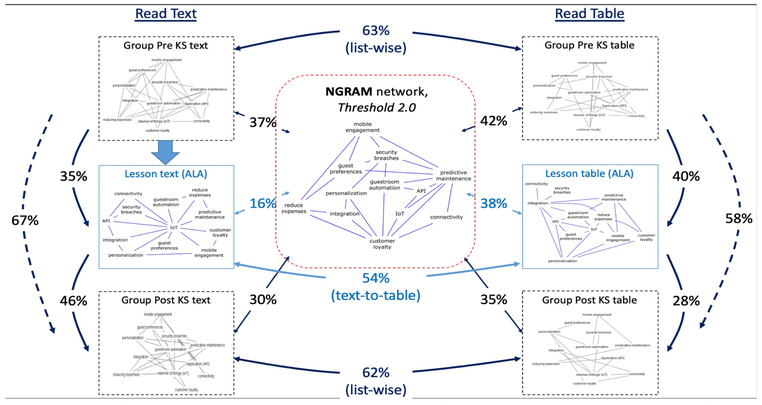


POST

1 between, 1 within ANOVA of posttest data						
Source	SS (III)	df	MS	F	Sig.	
Intercept	47.451	1	47.451	425.675	0.000	
treatment (text or table)	0.774	1	0.774	6.942	0.023	*<-- text > table*
Error	1.226	11	0.111			
Tests of Within-Subjects Effects						
items	7.731	9	0.859	4.445	0.000	
items * treatment	2.100	9	0.233	1.207	0.299	
Error(items)	19.131	99	0.193			

1. We could insist pre and post tests have correlation and the results on this comprehension test were statistically significant.
2. We see the mean of the post test was relatively higher than the one from pre test in text format, but found that in the table setting, the gap between pre and post was less than text setting.
3. We also found in regards to understanding the main idea, scores from students with table were dramatically dropped in comparison to text.

KS measurement - Comparison of networks (common links % with listwise approach) - This comparison explains the network similarity among these analysis factors.

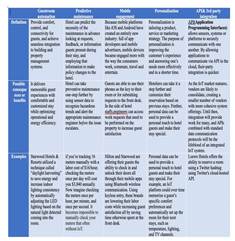


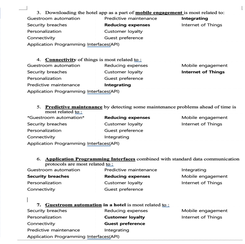
1. We could insist pre and post tests have correlation by their overlap and the results on this sorting task were consistent with comprehension test in regards to the pre and post (62 and 63%) and table and text setting (67 and 68%).

2. We also see the post test of text has more overlap(35 and 46%) with lesson text which can explain the treatment effect, but found the similar consequence with the result of comprehension test. That is in the table setting, post- table had less similarity with lesson table(40 and 28%) effect. had the gap between pre and post was less than text setting.

METHODS

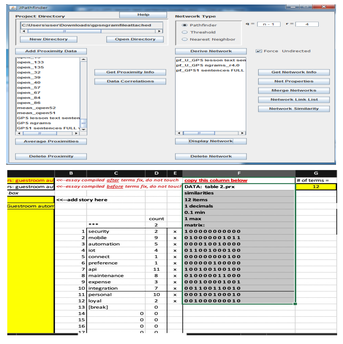
- **Participants U**ndergraduate students from a hospitality management course who received extra credits with the participation were voluntarily tested in the study(N=13).
- **Design and Materials.** The web-based test consisted of 5 sections: 10 prior knowledge questions and 12 prior knowledge sorting tasks and received two different interventions(text vs table). Finally, two 10 post knowledge questions and 12 sorting tasks. For the prior and post knowledge questions, two inference questions and eight recall questions were included. 11 keywords were picked by expert (n-1) for this sorting task and students were asked to pick two most related words to the keyword on each question.





Measurement	Treatment (intervention)	Pre-Test	Post-Test
Sorting	text	11	11
	table	10	10
Comprehension Test	text	10	10
	table	10	10

MC Validity test: pre Cronbach alpha= .668
Post Cronbach alpha= .65 (8questions)



PFNet : all of the participants' map proximity data were converted into network representations of structural knowledge using the Pathfinder Network (PFNet) approach. A PFNet is comprised of a concept represented by nodes and links between nodes to demonstrate relationship.

ALA reader : a software tool that converts written text summaries directly into proximity files (prx) that can be analyzed by Pathfinder software.

CONCLUSIONS

Limitations

- No supportive theoretical background to assume that an Ngram normative network can be considered as influencing learners' possible prior knowledge, so we need more control to the research setting to see the effect of Ngram normative network.
- Table and text have not perfectly matched contents to respond questions.
- The correlation between KS measurement and the problem questions were not measured-reliability of certain questions is low so needed to drop two post questions.

We will modify those errors and re-conduct the research. Additionally, we would add Ngram pathfinder networks again to build more evidence.