Learning from Schematic Visuals of Financial Ratios[1]

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ABSTRACT

This study examines whether stakeholders of financial data will accept a schematic big-picture visual of financial ratios and whether they think this type of visual will increase their learning performance. A schematic big- picture visual was constructed from the financial data of a large food processing manufacturer and its respective industry. The visual, which was designed to include all data items on a single page, was used as the central point of the survey instrument. Self-administered questionnaires were either mailed to or hand-delivered to three financial-related data user groups: preparers, management users, and reviewers. With a 17.7% response rate (96 respondents), the results showed a relatively high intention to use the schematic big-picture visual. The respondents had a relatively high positive attitude and perceived the visual to be useful. They also thought that they learned quite a bit from the visual about the risk and financial status of the sample organization. They thought, however, that the amount and complexity of information to be processed was high. In terms of the study model, learning related higher than attitude to the intention of using the visual.

Keywords: Schematic visuals, financial ratios, technology acceptance model, learning levels

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1. INTRODUCTION

Financial data has been used by various groups of stakeholders to assess a firm's status. Although the preparation of financial statements appears to follow a pre-defined format, with the advent of computer technology, especially in the area of business analytic software, it is now possible for the preparer to be more creative and for management users to be more demanding. For financial ratios, no apparent format stands out. Many commercialized tools have embraced the holistic view of presenting business data in a tabular or listing format. In the case of financial ratios, the value of each ratio is listed with a drilled-down capability (www.sapdesignguild.org/editions/edition2/orion.asp). This holistic view of design assumes users to be domain experts who can see relationships easily through the hierarchical groupings and listings [Tomsky and Ebert, 2000].

Depending on the nature of the task being carried out and the amount of time a person has, a financial report user (insider or outsider) may choose a group of items or ratios differently. Based on Gestalt principles of perception [Soegaard, 2010], a certain item may have been chosen if it can simply re-awake familiar mental images that can provide some kind of closure or a big picture in the mind of the user. With each additional financial data item that is chosen, the mind will undergo cognitive and existential remodeling so as to achieve a holistic view of the structure and meaning of a business situation as quickly as possible.

Also, from the sense-making perspective [Dervin, 1992], users of financial data learn to make sense of what they see by determining the relevancy of the information to a purpose and then extracting – as well as putting back – the information so it can be used in congruence with the way they see the world. These pieces of data may or may not give the big picture of the financial position of an organization.

2. LITERATURE REVIEW

This section presents a review of the literature as it pertains to schematic big-picture visuals, technology acceptance models, and learning from schematic big-picture visuals.

2.1. Schematic Big-Picture Visuals

Because diagrams can amplify cognition, they are typically used to communicate complex information systems during the analysis and design phases of an information system. Examples include data flow diagrams, entity-relationship diagrams, and use case and activity diagrams. These diagrams are hierarchical in nature, starting with the whole system and then breaking down to subsystems hierarchically. Not many diagrams of financial data have been drawn or widely used. One very good example of a schematic visual for financial ratios is the DuPont analysis model, which has been widely used in business and is included in many financial management textbooks. An example diagram using this model is shown in Figure 1. Although the original model starts with the return on assets (ROA) ratio, the example shown here depicts the flow of financial data leading to the return on equity (ROE) ratio. Earnings before the interest and taxes (EBIT) ratio has been included in this example chart.

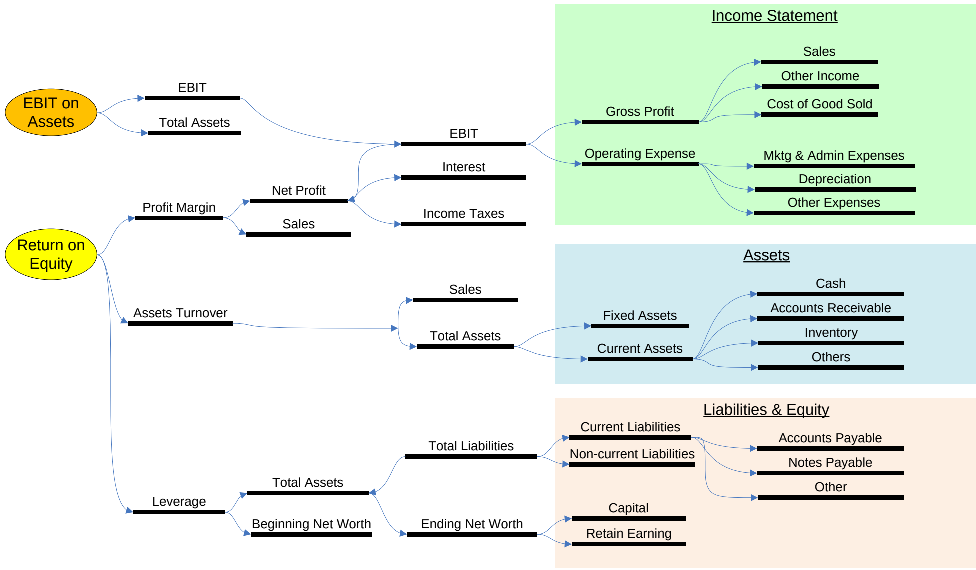


Figure 1. Example of Schematic Visual – Adapted from Enhanced DuPont Analysis
http://www.exceluser.com/solutions/dupont1.htm

The preferred way to present financial data, however, is still in a table format with numbers. Business professionals seem to feel more secure when they see and use symbolic data to understand and assess a company's financial position. Nevertheless, spatial data such as two-dimension (2D) and three-dimension (3D) graphs have become the most popular supplement after the proliferation of spreadsheet programs. Despite their popularity, spreadsheet graphs are often presented one by one without providing a holistic view to users.

This shortcoming has led nowadays to the increasing attractiveness of business intelligence software that often places a series of graphs together on a single screen called a dashboard so that users can form a big picture of the data being presented [Few, 2006; Yigitbasioglu, and Velcu, 2012]..

A review of the literature reveals a prior study that suggests that a 2D diagram of financial ratios with input and output data items could present a big picture of a firm's financial position [Tanlamai and Tangsiri, 2010]. In that study, preliminary interviews with boundary users and audit committees found no conclusive results as to whether the proposed 2D diagram of a firm's financial performance would be accepted by various groups of stakeholders. The study used a diagram depicting five groups of key business ratios that had been calculated from balance sheets and income statements to present to the users without reference to any specific company's data. These five groups were Liquidity, Leverage, Activity, Profitability, and Cash Management Ratios.

Although the spatial arrangement of objects in the diagram itself did not follow any specific design theory, the diagram had been drawn so as to present all selected ratios with their data sources on a single page. This was expected to provide an overall view of the data needed in order to provide the big picture of a focal organization. Some interviewees indicated that the big-picture diagram was too complex, but others found the diagram to be useful although it was insufficient. Experts in accounting and finance appeared to think that the schematic big-picture visuals were not useful because they memorized the formula of each ratio by heart and they would have preferred to see the drivers of each ratio instead. It appeared that these schematic visuals were too complex, resulting in both a cognitive and information overload for users.

Although the majority of the boundary users indicated that a schematic big picture of financial ratios did not help with their perceived learning needs, they thought the inclusion of such diagrams was of some use in the company's public information materials (e.g., annual reports) because users could find all the ratios and source data together in one place.

In the present study, a similar 2D diagram of financial data was constructed to examine its big-picture effect on different groups of stakeholders. Thus, the objective of this study is to examine whether stakeholders of financial data will accept the schematic big-picture visual of financial ratios, whether they think this type of visual will increase their learning performance, and whether they intend to use the visual to represent financial data.

2.2. Technology Acceptance Model

The Technology Acceptance Model (TAM) is one of the most referred to frameworks in the area of system implementation. The model was originated and made famous by Davis and his colleagues [Davis, 1989; Davis, Bagozzi, and Warshaw, 1989] and has been validated, modified, and integrated into other constructs by numerous researchers [Venkatesh and Davis, 1996; Venkatesh and Davis, 2000; Venkatesh, Morris, Davis, and Davis, 2003; Wixom and Todd, 2005]. The main premise of the original model, however, was to argue that users will develop an intention-to-use behavior from two basic constructs; namely, the perceived usefulness and the perceived ease of use of a new system. Behavior intention then serves as the mediator of actual system use.

TAM has been used to study the implementation and adoption of new technology, new concepts, new information systems, and so on. The implementation includes word processing, Internet banking, telemedicine technology, online shopping, e-commerce, e-mail, online games, and enterprise resource planning systems. See the review of TAM in the Theories Used in IS Research Wiki with detailed references originating at York University (http://www.fsc.yorku.ca/york/istheory/wiki/index.php/Technology_acceptance_model).

In the area of financial data representation, schematic visuals like the DuPont chart are quite rare. Results from the preliminary study examining the acceptance of a schematic visual of financial ratios by audit committees were inconclusive. Also, only one group of users was examined in that study. The present research uses the TAM framework to examine the acceptance of a schematic big-picture visual in presenting financial ratios, along with the data used to calculate these ratios. Although accepting this alternative visual presentation, stakeholders might still be skeptical if they do not understand the visual itself; therefore, the extent of their intention to use this new visual may be minimal. Thus, a learning model is added to the study framework.

2.3. Learning from Schematic Big-Picture Visuals

One of the many relatively popular instructional models of learning is the graphics organizer model of learning. The model illustrates different types of graphics that can enhance cognitive learning: chain of events, clustering, compare/contrast, continuum, cycle, family tree, fishbone, interaction outline, problem/solution, spider, storyboard, and Venn diagram (http://eduscapes.com/tap/topic73.htm). By organizing a huge amount of information into a single picture, different perspectives can be taken because words are removed and the focus is shifted to the connection of ideas and topics. Thus, diagram tools like Concept Map and Mind Map have become popular organizing tools and are being introduced to so many levels of education, ranging from kindergarten to MBA.

This learning model can easily be applied to schematic big-picture visuals such as the diagram of financial ratios being proposed in the present study. The diagram is a paper-based version of the schematic visual that was developed by including all relevant data into a single page. Although the visual is intended to give the big picture, many pieces of information being presented are likely to require greater processing activities. Many users, especially those who are not familiar with the diagrammatic way of data representation, may find the diagram demands cognitive load during their learning process. In cognitive learning theory, a learner's mental structure is constantly refined from processing information or visualizing symbols in his or her working memory [Sweller, van Merrienboer, and Paas, 1998]. Cognitive load and information load as attributes of the information or visuals being processed can easily influence the user's level of learning [Rose, Rose, and McKay, 2007].

In sum, the two theoretical bases, TAM and cognitive learning theory, were used to study financial report users' intention to use the schematic big-picture visual of financial ratios. Figure 2 shows the initial conceptual framework of the study. Relationships of the study constructs were examined with the following questions in mind:

- Will this type of big-picture diagram be accepted by different stakeholder groups of financial reports (within the threshold of their cognitive load and information load)?
- To what extent do ease of use and usefulness relate to user attitudes and, subsequently, the intention to use a schematic big-picture of financial ratios?
- Can an experience with schematic visuals influence learning and subsequently the intention to use a schematic big-picture visual of financial ratios?

Note that the present study focuses only on the financial ratio analysis domain.

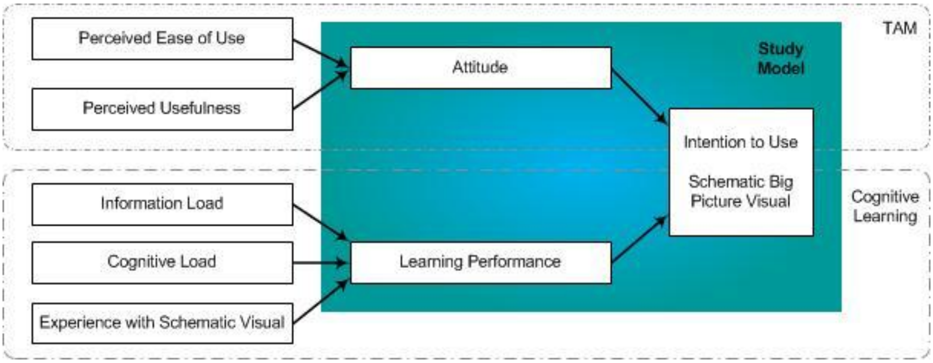


Figure 2. Conceptual Framework for the Current Study

3. RESEARCH METHOD

This section describes the data collection process and the survey instruments used in this study.

3.1. Data Collection

Many groups of stakeholders, both within and outside the organizational boundary, use financial ratios to assess the risk and performance of a company. As shown in Figure 3, the stakeholders who are within the organizational boundary are accountants, managers, and internal auditors. Those who are either at the organizational boundary or outside the boundary entirely include audit committees, external auditors, creditors, and investors.

This study focuses on three major groups of stakeholders who take the role of preparer, user, and reviewer of financial ratios on a regular basis. They are the accountant whose responsibility is to prepare financial reports and related financial ratios, the manager who will use the reports for decision making in various capacities, and the external auditor who will review and validate the adequacy of financial reports. Boundary users and other stakeholders are not addressed in the present study.

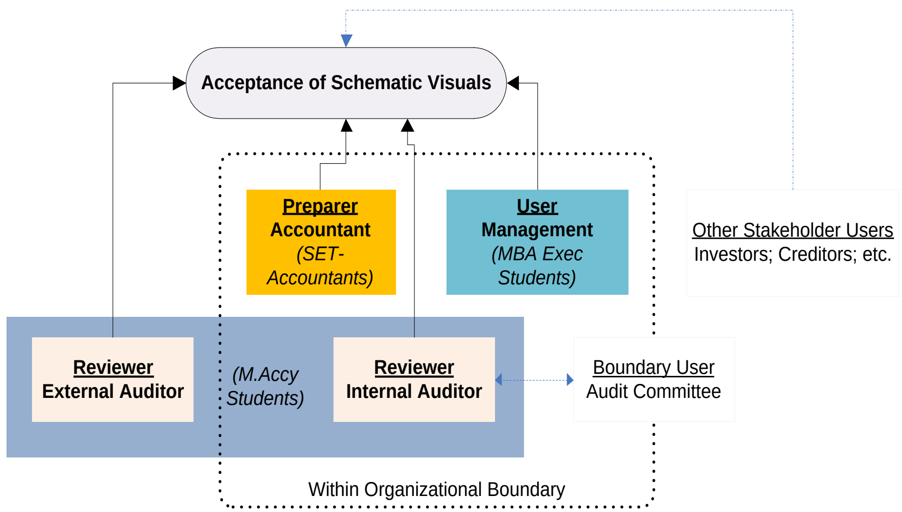


Figure 3. Sampling Frame Showing Stakeholder Representative Groups

This study uses the census technique, with the sampling frame representing the three stakeholder roles as follows:

- *Preparer*: To represent preparers were Directors of Accounting and Finance from all companies listed on the stock exchange of Thailand, excluding the service and financial sectors. They provided data and prepared financial ratios to management and auditors.

- *Management*: To represent management users were executive MBA students with at least 8 years of experience prior to entering the program. These managers were in their last semester before graduation and had already taken accounting and financial management courses that included financial ratios as part of the course contents. The majority had used financial ratios in their work.

- *Reviewer*: To represent reviewers of financial data were two groups of students. Master of Accountancy (executive programs in financial accounting and managerial accounting with at least 3 years of experience) were included. The majority of students in financial accounting were auditors or Certified Public Accountants and management accounting students (mainly internal auditors). The job of both external and internal auditors is to use financial ratios to review performance of a firm.

Since previous studies with a similar sampling frame had received an average response rate of 10-15%, a non-monetary motivation was included in this study. In the introductory letter, the prospective respondents were told that a small donation to the Red Cross would be given on their behalf for every questionnaire returned. The response rate from a mail survey to corporate accountants who prepare financial ratios was 10.2% (34 from 333 of the questionnaires sent out). Management users were represented by the Executive MBAs from a large public university, and they had a 24.7% response rate (30 of 121 persons). Master of Accountancy students from the same university were used as the proxy for reviewers of financial ratios, and had a 37.2% response rate (32 of 86 persons). The overall response rate was 17.7% (96 out of 540 persons). Although the rates differed from one group to another, the actual number of respondents was about the same (30 and more persons), making comparison possible between groups. However, the relatively small response rates, especially for the first group (accountants from listed companies) were affected by the on-going political and environmental problems of the country. During the last three years (2009-2011), such problems as airport seizure and close-down, yellow-shirt and red-shirt riots, and countrywide droughts and floods have threatened the routine ways of life and day-to-day business operations. Thus, follow-ups had to be done by e-mails only. Consequently, additional responses received after the follow-ups were minimal.

The general respondent profile is shown in Table 1. The majority of respondents had 6-10 years of experience in preparing and analyzing financial data in graphic format, 35.4%. Many of them had worked in fields related to accounting and finance (43.7%) and in service industries (25.0%). In terms of work position, almost half were accountants.

3.2. Survey Instruments

Data from a consumer product company was used to construct a schematic big-picture visual of financial ratios that was designed to include all data items on a single page of paper (see Appendix). The visual was used as the central point of the survey instrument that was based on the Technology Acceptance Model (TAM) and cognitive learning theory. The primary data was collected using a self-administered questionnaire accompanied with a pre-addressed, stamped envelope. Also, the questionnaire items, though based on previous research, were modified so as to convince prospective respondents that it would take only 10-15 minutes to answer the paper-and-pencil questionnaire.

Table 1
Profile of Survey Respondents
(%)

PROFILE	PROFILE DETAILS	Pooled Responses (ALL) *N= 96*	Preparer (SET) *N=34*	Manager (MBA) *N=30*	Reviewer (AUD) *N=32*
Experience*	Less than 1 year	16.7	5.9	33.3	12.5
	1-5 years	35.4	20.6	30.0	56.3
	6-10 years	24.0	26.5	16.7	28.1
	>10 years	20.8	44.2	16.7	-
Industry Group	Agro & Food	7.3	8.8	3.3	9.4
	Technology	11.5	14.7	16.7	3.1
	Consumer Product	7.3	5.9	10.0	6.3
	Resources	7.3	8.8	10.0	3.1
	Industrials	17.7	29.4	16.7	6.3
	Property Construction	14.6	32.4	3.3	6.3
	Financials	8.3	-	16.7	9.4
	Services	25.0	-	23.3	53.1
Work Position	Accountant	43.6	100.0	3.3	21.9
	Management	27.1	-	66.7	18.8
	Auditor	15.6	-	-	46.9
	Others	9.4	-	23.3	6.3

Note: Real percent (not valid percent – excluding missing data) is reported in this table.
*Experience in preparing and analyzing financial data in graphic format.

In all, the survey instrument included these constructs:

- Perceived ease of use (PE)
- Perceived usefulness (PU)
- User attitudes (Attitude)
- Behavioral intention (BI)
- Information processing attributes (IP)

- Experience with schematic visuals (EXP)
- Learning levels (Learning)

The items from TAM's framework were modified from the original items in TAM [Davis et al., 1989] and items from Taylor and Todd [1995]. Actual financial data from food processing companies was used to calculate the needed financial ratios. Included along with the ratios was the input data needed to calculate the ratios. The input data was rounded off for easier data comprehension. Last year's data, the current year's data, and the industry's average data were shown in each individual object of the diagram.

Perceived Ease of Use (PE) is a construct from the TAM, which is one of the most robust models in information systems literature. The PE construct is used to measure a person's willingness to use a new system, based on the perceived ease of use. A 7-point Likert scale was used to measure the construct; namely:

"Very easy"	1
"Easy"	2
"Somewhat easy"	3
"Neutral"	4
"Somewhat difficult"	5
"Difficult"	6
"Very difficult"	7

Users expect not to spend too much effort using a new system. As Davis and his colleague put it, ". . . Perceived ease of use refers to the degree to which the prospective user expects the target system to be free of effort . . . ." [Davis et al., 1989, p. 985]. Besides perception regarding operational use, this construct emphasizes the issue of learning as well [Taylor and Todd, 1995]. In this study, questions include:

- Is showing financial data with the schematic big-picture visual easy or difficult?
- Does the schematic big-picture visual take a shorter or longer time to develop?
- Is it easy or difficult to learn the firm's financial status using the schematic big-picture visual?

Perceived Usefulness (PU) is another construct reflecting the perspective of users. According to TAM, ". . . Perceived usefulness is defined as the prospective user's subjective probability that using a specific application system will increase his or her job performance within an organizational context . . . . [Davis et al., 1989, p. 985]. The semantic differential of adjective pairs was used to measure perceived usefulness of the schematic big-picture visual. The measures were drawn from previous work [Bailey and pearson, 1983; Hartwick and Barki, 1994; Louis, 1985; Tanlamai, 1990; Tanlamai, Simis, and Liu, 1989]. The adjective pairs addressed the following questions:

- Is it satisfactory to present financial data with the schematic big-picture visual?
- To what extent does the schematic big-picture allow you to be enthusiastic?
- Is it a positive experience to present financial data with the schematic big-picture visual?
- To what extent does the schematic big-picture visual increase the ability to learn faster (more efficiently)?
- To what extent is the schematic big-picture visual useful to a user's work?
- To what extent can the schematic big-picture visual enable you to accomplish tasks more quickly?
- To what extent does the schematic big-picture visual allow you to see your job content?
- Does using the schematic big-picture visual increase your confidence?
- To what extent is the schematic big-picture visual valuable?
- To what extent does the schematic big-picture visual give adequate information?
- To what extent can the schematic big-picture visual increase the ability to gain insights into a firm's operations (effectiveness)?

User Attitudes (Attitude) toward a new system such as the schematic big-picture visual can affect its use. The semantic differential technique was used to measure attitudes. This question was modified from Hartwick and Barki [1994]. Adjective pairs were used as the metric or measurement because they measure the overall attitudes of the user on both cognitive components and affective components. Since it is difficult for the two components to have separate measures, adjective pairs are popular in various research studies [Bailey and Person, 1983]. The choice of which and how many adjective pairs to include was based mainly based on the researcher's experience and prior research. The number of pairs being used varied as well – typically ranging from 2 to 12. Multiple measures and Cronbach coefficient alphas were used to provide reliability. Prior research used the 7-10-point Likert scale in between adjective pairs. In this study, 10 adjective pairs were used for each of two attitude questions, along with a seven-point Likert scale. Example adjective pairs include:

good/bad	ready/not ready
acceptable/unacceptable	satisfactory/unsatisfactory
positive/negative	adequate/inadequate

Behavioral Intention (BI) or intention to use the schematic big-picture visual is the final construct of the study model. According to TAM, intention to use the new system is the construct leading to actual system use [Davis et al., 1989]. Since the measures for intention to use the big-picture diagram of financial ratios have not been found in previous literature, the survey instrument in the current study was based partially on questions used in ERP implementation research [Tanlamai and Ritbumroong, 2007]. Again, the 7-point Likert scale (ranging from "strongly agree" to "strongly disagree") was used for the following questions:

- Do you intend to use the schematic big-picture visual?
- Are you planning to apply the schematic big-picture visual in presenting the financial data of your company?
- Do you plan to introduce the schematic big-picture visual to colleagues in other organizations?
- In what way (positive/negative) do you plan to tell your supervisors or subordinates about the schematic big-picture visual?

Perceived Learning Gain was based on Bloom's seven learning levels; namely, knowledge, comprehension, application, analysis, synthesis, evaluation, and insight. On a 7-point Likert scale (ranging from 7=learning the most, to 1=learning the least), the subjects were asked to rate the extent of learning gained after using the schematic big-picture visual to assess the risk and financial status of the sample company. To examine the reliability of measures for this construct, factor analysis was performed. Only one component was found with a 76.8% of variance, which was explained by the first factor with a factor loading of greater than 0.85 on every measure. The Cronbach alphas for all 7 items were 0.95, indicating highly reliable measurement. Thus, sum scores of learning gain were used to represent this construct in further analysis.

Information Load and Cognitive Load. Individuals differ in their cognitive processes and their spatial visualizing capability. Zimowski and Weothke [1986] differentiated two types of information processing ability – (1) the analogy ability of structural visualization, and (2) the non-analog ability of verbal analytic reasoning. They found that the former involved holistic Gestalt-like processing of visual-spatial information and that the latter was useful in testing general intelligence and verbal processing abilities. Although there are many aspects of individual differences that can influence learning, the current study focuses on two immediate factors when an individual processes and learns a new visual cue – (1) whether there is too much information (information load), and (2) whether the information is too complex (cognitive load). Prior experience with schematic visuals was also included as a control variable.

Besides the two groups of constructs stated, the respondents were asked to choose the financial data items they would use to assess the performance and risks of the focal organization. The items included those on the profit and loss statement and the balance sheet, as well as different types of financial ratios. In addition, respondents were asked whether they thought other stakeholders might be involved in developing and selecting financial data items to be included in the schematic visual. They were also asked to identify the types of information systems being used to create schematic visuals; for example, a spreadsheet program, accounting program, ERP, or such.

4. RESULTS

The descriptive statistics in Table 2 show that intention to use (BI), attitude, perceived usefulness (PU), and perceived learning performance were above average (means of the mean-score are greater than 5 on a 7-point scale). On a 7-point scale, respondents perceived the schematic big-picture visual to be rather difficult to use (4.48) with a somewhat high information load (4.38) and a slightly higher than mid-point (3.97) for cognitive load. The respondents had an average level of experience with schematic or diagram types of data presentation. The distribution of data was somewhat skewed for intention (BI), attitude, and perceived usefulness (PU).

Table 2
Descriptive Statistics for the Current Study
(N=96)

All Responses *N=96*	**Sum-Score of Multiple Measures**			**Skewness**	**Mean-Score of Multiple Measures**		
	Min	***Max***	***Mean, SD***		***Min***	***Max***	***Mean, SD***
Intention (BI)	5.00	28.00	21.30, 5.68	-1.068	1.25	7.00	5.32, 1.42
Attitude	5.00	70.00	50.06, 12.57	-1.375	1.56	7.00	5.12, 1.10
Ease of Use (PE)	3.00	21.00	13.45, 3.88	-0.324	1.00	7.00	4.48, 1.29
Usefulness (PU)	5.00	70.00	50.76, 10.87	-1.415	1.80	7.00	5.13, 0.98
Learning	14.00	49.00	35.85, 7.35	-0.763	2.00	7.00	5.13, 1.05
Information Load	2	7	4.38, 1.32	0.109	2	7	4.38, 1.32
Cognitive Load	1	7	3.97, 1.40	0.057	1	7	3.97, 1.40
Viz Exp (EXP)	1	7	3.63, 1.68	0.052	1	7	3.63, 1.68

Construct validity was examined for every construct shown in the study framework. Since many of the constructs were developed using multiple-item measures in order to avoid misinterpretation of a single item measure, the authors carried out reliability (coefficient alpha) and internal consistency (item-to-total correlation statistics) and unidimensionality with principal component analysis and factor extraction. The Kaiser-Meyer-Olkin (KMO) measure and the Bartlett's test of sphericity were also used to determine whether the given data was sufficient for a factor analysis (the statistics are significant at the 0.001 level). The statistics in Table 3 show that all multiple-measure constructs are statistically valid (KMO close to 1) and also reliable (Cronbach coefficient alphas > 0.7). The cumulative variances were greater than 60% for the first factor, and 70% if two factors were found.

Table 3
Testing Statistics for Construct Validity and Reliability

All Responses *N=96*	**Mean, SD**	**Cron-bach**	**KMO**	**Bartlett Test (p-value)**	**Range, Item-to-Total**	**Cum. Var. by 1st Factor**	**Cum. Var. by 2nd Factor**
Intention (BI)	21.30, 5.68	0.932	0.711	340.94 (0.000)	0.793-0.855	83.07	-
Attitude	50.06, 12.57	0.921	0.869	701.54 (0.000)	0.571-0.923	61.09	71.51
Ease of Use (PE)	13.45, 3.88	0.820	0.669	117.12 (0.000)	0.597-0.810	73.85	-
Usefulness (PU)	50.76, 10.87	0.937	0.919	870.40 (0.000)	0.699-0.845	66.87	78.09
Learning	35.85, 7.35	0.950	0.872	644.30 (0.000)	0.730-0.823	76.79	-
Information Load	4.38, 1.32						
Cognitive Load	3.97, 1.40						
Viz Exp (EXP)	3.63, 1.68						

Notes:
Cronbach = Cronbach's coefficient alpha
Bartlett Test = Bartlett's test of sphericity
Range = Range of communality, item-to-total
KMO = Kaiser-Meyer-Olkin statistics
Cum. Var. = Cumulative variance

Because of low response rates in all three stakeholder groups, the Analysis of Variance (ANOVA) was performed on every measure to see whether there was any difference among the three groups. Except for one measure, "usefulness," in the perceived usefulness (PU) construct that had a statistical significance among the means ($F_{(2,94)}$ =3.53, p=0.033) of the three stakeholder groups (for Preparer =5.26, 1.33; for Manager=6.03, 1.05; and for Reviewer=5.75, 1.20), no difference was found in any other measures. Also, none of the Levene statistics for the test of homogeneity of variance were significant by any measures, except for two measures in the perceived ease of use (PE) construct (ease of representing data with schematic visual, and speed of preparing schematic visual). Thus, pooled responses will be used, and the sum scores of multiple measures for each construct are used for all analyses hereafter.

4.1. Interrelationship of Variables

Table 4 shows the Pearson correlation coefficient matrix of the constructs shown in the framework. All directions of the relationships were in the expected direction, with the majority of correlation coefficients being significant at a 99% level of confidence for all TAM and learning constructs, as well as almost all those relating to cognitive load.

The correlation coefficients between major constructs and information load and experience with schematic visuals were not significant.

- Attitudes and learning related highly to each another (r=0.547, p=0.000)
- The same was true of perceived ease of use and perceived usefulness (r=0.385, p=0.000)
- It was also true for information load and cognitive load (r=0.420, p=0.000).

On the other hand, information load and experience with schematic big-picture visuals did not seem to relate to TAM constructs except for perceived ease of use (r=-0.291, p=0.004). Specifically the greater the information load, the lower the ease of use. However, there were high, significant correlations between cognitive load and every construct:

- The greater the cognitive load, the less intention to use (r=-0.425, p=0.000).
- The lower the attitude (r=-0.220, p=0.032), the lower perceived ease of use (r=-0.535, p=0.000).
- The lower perceived usefulness (r=-0.208, p=0.043), the less learning (r=-0.433, p=0.000).

4.2. Analysis of Models in the Study Framework

Because of relatively high correlation coefficients among these summative constructs and to avoid multicollinearity, simple regression was used to examine the relationships. As shown in Table 5, the part of the TAM model that shows the strongest relationship is that between attitude and perceived usefulness (adjusted R^2 = 65.5%). For the cognitive learning model it was between learning and cognitive load (adjusted R^2 = 17.9%). The interesting part is that learning explains intention more than attitude does, with an adjusted R^2 of 34% for the former, compared with 25% for the latter. No relationship was found between learning and information l. Regardless of the amount of information load, no effect was found on the amount of learning gain being perceived.

Table 4
CORRELATION COEFFICIENTS FOR ALL CONSTRUCTS

N=96	BI	Attitude	PE	PU	Learning	Infor-mation Load	Cog-nitive Load	EXP
Intention (BI)	1							
Attitude	0.508***	1						
Ease of Use (PE)	0.667***	0.370***	1					
Usefulness (PU)	0.534***	0.812***	0.385***	1				
Learning	0.589***	0.547***	0.522***	0.521***	1			
Information Load	-0.091	-0.013	-0.291**	-0.087	-0.034	1		
Cognitive Load	-0.425***	-0.220*	-0.535***	-0.208*	-0.433***	0.420***	1	
Viz Exp (EXP)	0.137	0.120	0.241*	0.142	0.102	0.140	0.341***	1

p<=0.001, p<=0.01, *p<=0.05
BI = Behavioral intention
PE = Perceived ease of use
PU = Perceived usefulness
EXP = Experience with schematic visuals

Table 5
SIMPLE REGRESSION ANALYSES FOR MODELS IN THE STUDY FRAMEWORK

Dependent Variable	Independent Variable	Std Beta	Adjusted R^2 in % F-statistics	Durbin Watson	N
Intention	Attitude	0.508 t =5.722, p=0.000	25% F = 32.74, p=0.000	2.032	96
Intention	Learning	0.589 t = 7.061, p=0.000	34% F = 49.85, p=0.000	1.952	96
Attitude	Perceived Ease of Use	0.370 t= 3.857, p=.000	12.7% F = 14.876, p=0.000	1.839	96
Attitude	Perceived Usefulness	0.812 t=13.4, p=0.000	65.5% F=179.563, p=0.000	2.119	95
Learning	Information Load	-0.034 t=0.333, p=0.840	-0.9% F=0.111, p=0.740	1.902	95
Learning	Cognitive Load	-0.433 t=-4.657, p=0.000	17.9% F=21.685, p=0.000	1.908	96
Learning	Experience with Schematic Visual	0.102 t=0.997, p=0.321	0% F=0.994, p=0.321	1.887	95

4.3. Other Descriptive Data

Of the 62 items of financial data, 22 were selected by more than 50% of respondents. Sales and net profit were the two most frequently chosen. Five of these ratios were from the profit and loss account and six from the balance sheet. Only three were from popular financial ratios. The rest reflects indicators of day-to-day operations. As shown in Table 6, five of the most frequently chosen items were sales, net profit, current ratio, return on assets, and gross margin. As expected, these chosen items did fit with the DuPont analysis model where financial performance, asset use, and leverage were the three most sought-out financial data items. The order of consideration might differ depending on the type of industry within which the company resides. Basic data had been chosen prior to ratios. Stakeholders – whether they were preparers, managers, or reviewers – would start their financial assessment and analysis with "how much a company makes" before venturing into other information.

In terms of acceptance and potential use of the schematic big-picture visual (Table 7), respondents felt that investors (83.3%) and shareholders (81.3%) were the two groups who were most likely to do so. These people would help make decisions as to which financial data items were to be included in the diagram. Once the needed items were chosen, the process for arranging them into the needed visuals could be developed. The respondents also felt that it was the responsibility of IT staff (62.5%) and internal auditor (41.7%) to provide the inputs for development of a similar diagram for their organization. When asked about the software being used to produce diagrams and graphic representations, a few mentioned accounting software, some ERPs, but the majority cited spreadsheet applications. The response was not unexpected. Previous research had found spreadsheet graphs to be plentiful in public domain information—e.g., annual registration statements, annual reports, and company websites [Tanlamai and Tangsiri, 2010].

Table 6
Frequently Used Financial Data Items

Financial Data	Freq.	%	Rank	P&L	B/S	Ratios	Others
Sales	82	85.4	1	x			
Net Profit	76	79.2	2	x			
Current Ratio	71	74.0	3			x	
ROA-Return on Assets	70	72.9	4			x	
Gross Margin	69	71.9	5				x
Sales Growth	67	69.8	6				x
EPS-Earnings Per Share	67	69.8	7				x
Gross Profit	66	68.8	8	x			
Operating Cash Flow	65	67.7	9				x
Current Assets	64	66.7	10		x		
ROE-Return on Equity	63	65.6	11			x	
Cash and Short-term Investments	62	64.6	12		x		
Total Assets	60	62.5	13		x		
Cost of Sales	59	61.5	14	x			
Total Liabilities	58	60.4	15		x		
Net Cash Cycle Days	57	59.4	16				x
Net Profit Growth	54	56.3	17				x
EBITDA	53	55.2	18	x			
Collection Days	52	54.2	19				x
Total Equity	49	51.0	20		x		
Free cash flows	49	51.0	21				x
Long-term Debt	48	50.0	22		x		
			Counts	5	6	3	8

Table 7
Acceptance and Involvement of Stakeholders
(%)

Stakeholder Groups	Acceptance & Potential Use	Development Involvement
Management	57.3	26.3
Internal Auditor	41.7	41.7
IT Staff	27.1	62.5
Shareholders	81.3	11.5
Independent Director	69.8	21.9
Investor	83.3	11.5
External Auditor	58.3	29.2
Accounts Payable/ Receivable	70.8	15.6
Investment Institution	59.4	30.2

5. DISCUSSION AND CONCLUSION

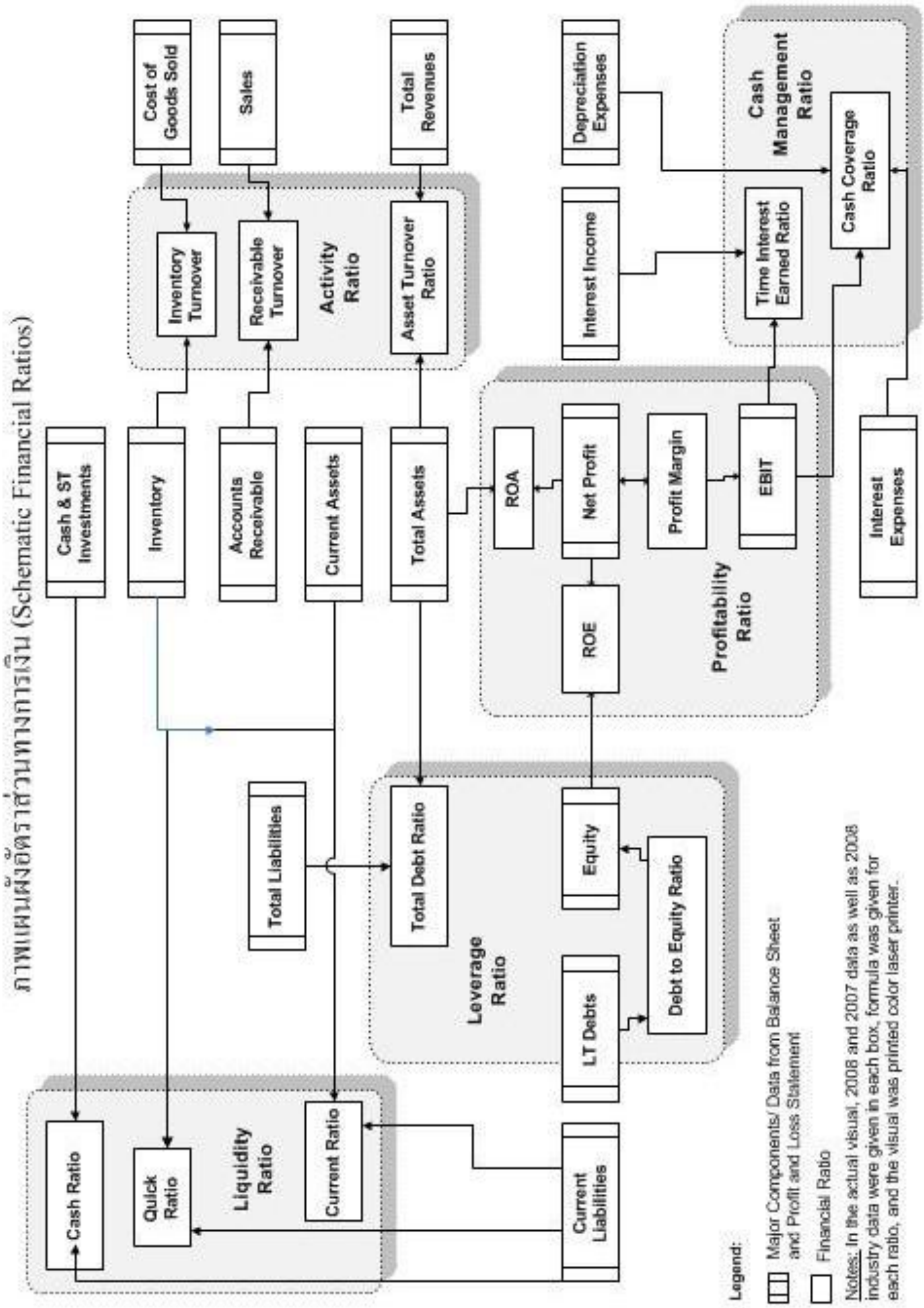
In this study, a schematic big-picture visual was designed to show financial ratios with corresponding source and destination items on a single page of paper. The promise of this visual is that it enables financial stakeholders to see everything at once. As is the case with flowcharts and diagrams, users should be able to follow, learn, and perhaps gain some insights about issues at hand faster and more easily [Dunn and Gerard, 2001]. Results from surveys of three groups of stakeholders (accountants, auditors, and managers) showed that the majority of stakeholders accepted the big-picture visual of financial ratios. They found the visual to be very useful, but not very easy to use. Partially explained by the general systems theory, users found big-picture visuals that contain a holistic view of the financial data to be useful [Choy and King, 2005].

One possible explanation for why the big-picture visual in the current study was considered difficult to understand is that the visual was presented in a paper-and-pencil format on a single A4, full-color sheet of paper, which requires a user to navigate through the visual on his or her own. No automation or drill-down capability of any kind was provided to the user. Although a majority of the respondents expressed their intention to use the visual, they felt that it required a high cognitive load in their part. Because so many salient financial data items were put in a single place, there was no easy point of entry; hence, some respondents considered the diagram too confusing.

In a typical finance and accounting scenario, financial statements contain a large amount of numerical data in table format. Expert users like accountants and auditors are likely to feel that the table format has already provided adequate information to meet their needs. Other general management and novice users, however, are likely to welcome an alternative format that would reduce their information processing loads. Most financial data users and stakeholders in the current study found the schematic big-picture visual used in this study to be relatively new, and felt that the number of data items and their relationships did not have much bearing on the information processing load of users. Although previous studies have found that diagrams can be used to amplify cognition [Burkhard, 2004], the schematic big-picture visual used in this study was complex and created high cognitive loads that hindered the learning gain of users. To address the limitation of this single-page diagram, it would be necessary to develop an interactive schematic visual with the capability of expanding and dwindling items as needed. Whether such a modified visual would be accepted by users and whether they would achieve a greater learning level could be the topic of future research. Also, research into the area of fitting tasks with appropriate navigation patterns can be of great interest in both academia and practitioners.

In a given decision-making environment, which piece of information to start the search and which alternative paths to be taken may differentiate the effectiveness of one decision-maker from another. Future research addressing the frame of reference in navigation of a user will augment the research direction of Dilla, Janvrin, and Raschke [2010], who proposed that system designers consider the role of interactive data selection and navigation tools in providing the fit between information representation types and task complexity. Previous research such as that conducted by Payne [1976] found task complexity to influence information search strategies; Moon and Keasey [1992] found the type and amount of accounting information being searched varied depending on how ill-defined the problem to be solved was. Finally, in today's neomillennial-leaning environment [Baird and Fisher, 2005], whether different search strategies (e.g., search by elimination versus additive search), would result in better learning and decision-making outcomes is yet to be explored.

Appendix
SCHEMATIC VISUAL OF FINANCIAL RATIOS



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