Analysis and Design: Assessing Actual and Desired Course Content

William J. Tastle
Ithaca College
Ithaca, New York 14850

Jack Russell
Northwestern State University
Natchitoches, LA 71497

ABSTRACT

A survey concerning the topics taught in the systems analysis and design course, how much time an instructor devoted to each topic and the perceived importance of the topics, was assembled from responses received from a posting to ISWorld list and the Information Systems Education Conference list of past participants. Using a consensus or agreement measure based on the Shannon entropy, the results are tabulated and ranked in order of entropy. Not all topics present in the "standard" textbooks are viewed as equally important, and some topics, like the creation of data flow diagrams and data modeling, while viewed as definitely important by IS educators, have a modest amount of time devoted to it by those same educators. Most topics could be grouped based on the agreed importance given that topic by IS educators and evaluated by the entropy measure. No agreement could be reached with regard to object-oriented technology.

Keywords: Systems analysis and design, systems content, IS education, agreement measure, consensus measure

1. INTRODUCTION

The purpose of this paper is, first, to determine if a hierarchical order exists among the topics common to most systems analysis and design textbooks based on the agreement of IS faculty who identify themselves as being instructors in the Systems Analysis and Design (SA&D) course. It is arguably safe to say that most business schools having majors or concentrations in information systems offer a course in SA&D. Though there is a recognized body of knowledge for the SA&D course (Longenecker 2002), instructors perceive topics as possessing differing degrees of importance. This importance differentiation has apparently not been studied; thus, this paper reports on a survey of IS educators who have ranked the topics that appear in the "generalized" SA&D textbook. The ranking is determined based on a agreement measure described later in the paper.

We investigated this problem using a **survey** (Appendix A) sent out to two list servers, one of predominantly information systems educators that have been associated with ISECON, the national Information Systems Education Conference (sponsored by the Foundation for Information Technology Education), the other list being the well-known ISWorldList sponsored by the Association of Information Systems.

A set of topics typically associated with most SA&D textbooks were identified by the authors. Though we chose topics that generally encompass the SA&D course, we did place an emphasis on the tools of analysis and design, for it is those topics that seem to be the more interesting and exciting, at least to the 2,000 plus students the authors have collectively taught over the past 50+ combined years.

We asked IS educators from both lists to estimate the amount of time they devote to each topic, and to identify if the presence of each topic in their SA&D course was deemed as being important to them. We seek to determine a relative ranking of topics as perceived by IS instructors.

2. THE TEXTBOOKS

The number of published SA&D textbooks changes annually, and each new entrant seems to put their own special brand on the way in which the material is presented and which material is covered to varying depths of detail. We examined the textbooks that have undergone several revisions over the years as well as some interesting relatively recent additions, and selected the following texts from which the topics were chosen:

Dennis, Alan and Barbara Wixom, "Systems Analysis and Design: An Applied Approach," John Wiley & Sons, Pub.

Fertuck, Len, "System Analysis & Design with Modern Methods," Wm C. Brown Communications.

Hoffer, Jeffrey, Joey George, and Joseph Valacich, "Modern Systems Analysis & Design," Addison Wesley.

Kendall, Kenneth and Julie Kendall, "Systems Analysis and Design," Prentice Hall.

Saldarini, Robert A., "Analysis and Design of Business Information Systems, Macmillan Press.

Whitten, Bentley, "Systems Analysis and Design Methods", Irwin-McGraw Hill.

The topics selected are contained in each question shown in the survey (see appendix A).

3. THE SURVEY

The faculty survey was sent to an unknown number of email addresses on the IS World list, but to some 300 email addresses on the ISECON list, some of which were returned as no longer viable, and a few individuals responded that they were not the proper person to receive the survey request. There were N = 33 respondents to the survey. The construction of the survey allowed individuals to respond to questions of course content from the perspective of the amount of time they devoted to that particular topic in their current classes. We refer to this set of choices as the "**topics taught**" set and the choices were partitioned as:

- none
- < 5%
- 5-10%
- 11-15%
- 16-20%
- 21-25%
- 26-50%
- >= 50%

From one semester to another it is expected that the absolute amount of time devoted to specific topics might change to some moderate degree, but the approximate percentage of time should be relatively consist from one year to the next. We grant that some paradigm shift would cause a major adjustment in the topics, i.e. the object paradigm of the past, but the topics in SA&D as reflected in the selected textbooks have been relatively constant.

For questions concerned with the perception of the degree of importance of concepts, the Likert scale was:

- definitely important
- somewhat important
- undecided
- somewhat unimportant
- definitely unimportant

This is referred to as the "**desirable features**" set.

3.1 Educator Background

The academic rank of the respondents was predominantly assistant professor (10) and associate professor (10), with professor (6), instructor (3), and adjunct professor (1) completing the set. Not all individuals responded to all questions, so the numbers for any one question may not properly sum to N. The average number of years teaching at the college/university level was 17, std = 8.0, and 63% taught exclusively at the undergraduate level.

3.2 Method of Analysis

The responses for each question were tabulated and carefully examined. It immediately became obvious that an average value for each question would not sufficiently capture the essence of the responses. Some questions resulted in responses in each possible category while other questions had responses limited to just a few categories of response. Since we want to identify distributions for which educators had the greatest agreement, we sought a measure that would provide the information in a manner that allows us to easily compare distributions. Such a measure exists as the Shannon entropy (equation 1). One of the reviewers felt strongly about the use of the mean and standard deviation as being a better measure than entropy to capture interval agreement, so we offer the following section before the more formalized discussion of entropy in section 3.4, and offer the table in Appendix E as an illustration why the authors have chosen entropy over standard deviation. Lastly, one of the authors comes from a background that is information-theoretic driven, hence a partial reason for the interest!

3.3 An Illustration of Entropy and Deviation

Given a set of variables labeled A through E, we have a choice of assigning a value to any or all variables. If we limit our choice to only variable A and assign to it, say 10, the mean is 2 and standard deviation (STD) is 4.47 (row 1 in Appendix E). The following scenarios all reference Appendix E.

From an information theoretic perspective, however, the selection of only one of the possible variables, regardless of the number placed in that variable, yields the same entropy, 0. If the value 20 is assigned to variable B, the mean is 4 and STD is 8.9; if the value 50 is assigned to variable E, the mean is 10 and the STD is 22.36 (see rows 2 and 3 in Appendix E). The amount of information contained in these rows remains unchanged, however, since only one of the possible variables has been selected. The entropy measure is zero, for one and only one variable has any value associated with it. It is obvious, then, that any permutation of variable will yield the same entropy value, but the mean and STD will vary. When any two variables are selected, as in row 4, the entropy increases for there is now some dissonance in the probabilities. When the same value is present in all the variables, as in row 13, the entropy is at its maximum and the relative entropy, the entropy associated with the distribution divided by the maximum entropy possible for that distribution, is at 100%. The STD is simply 0.

From this short illustration the authors submit that entropy offer a much more intuitive way of visualizing dissonance in a probability distribution.

3.4 The Entropy Measure as an Agreement Measure

We define an ideal agreement as one in which all respondents have selected the same category of response, that is, the same variables as illustrated by 3.3 above, for a given question. Thus, all respondents would have been in perfect agreement for any given question if they all had placed their response in the same category. For this study we seek to identify those topics of study for which there is greatest agreement. We note that perfect agreement was not reported by any survey question.

The application of the Shannon entropy to information-theoretic problems is well established in the literature, particularly in the seminal text by Klir and Folger (1988), Gray (1990), and a paper by Roberts, Everson and Rezek (2000). For this survey we create a probability distribution for each question in both the **topics taught** set and the **desirable features** set. The entropy is calculated for each distribution. Since the survey was partitioned into three parts, (1) the amount of time spent of each listed topic (see Appendix B), (2) the perceived importance of each topic in the traditional structured analysis course (Appendix C), and (3) the importance of topics in the OOA course (Appendix D), this analysis is similarly split out.

The Shannon entropy H, for a probability distribution p, is

$$H(p) = -\sum_{i=1}^{n} p_i \log_2 p_i$$

Equation 1

where $(p_1 + \ldots + p_n) = 1$, $0 <= p_i <= 1$, and $i \in \mathbb{N}$. It is common to use the natural log function as a substitute for $\log_2$. For this study we use

$$H(p) = -\sum_{i=1}^{n} p_i \ln p_i$$

Equation 2

to determine a relative ranking of individual distributions. The notation H(p) and H(X) are used interchangeably to represent the Shannon entropy, where X is the set of p's comprising the distribution of interest. The Shannon entropy is bounded by zero and a maximum value that is dependent upon the number of values in the probability distribution; its lower bound, H(X) = 0, is obtained with probabilities of all possible outcomes except one are equal to 0, and the upper bound occurs when the probabilities of all events are equal to 1/|X|, where X is the set of alternative outcomes as characterized by a particular probability distribution.

Thus,

$$0 \le H(X) \le \log_2 |X|$$

and similarly

$$0 \le H(X) \le \ln |X|$$

For each question that is a distribution of choices, each single choice is the perception of one IS educator. If the perceptions of all the IS educators were equally spread across all the choices for one particular question, we would agree that there was no agreement among them. Conversely, if every IS educator selected the same category as their choice we would infer perfect agreement on that question. As the choices move back and forth across the distribution, so does the sense of agreement, and the entropy measure allows us to capture that sense of agreement. To make comparisons intuitively easy, it is easy to employ a relative entropy measure, that is, the actual entropy divided by the maximum entropy, or

$$H_R(X) = H(X) / \ln(|X|)$$

where $H_R(X)$ is the relative entropy associated with a particular distribution,
H(X) is the actual entropy for the distribution of interest, and
ln(|X|) is the maximum entropy associated with the distribution.

By representing the dissonance as a percentage it is easy to make comparisons of agreement. A measure of 0% represents a complete lack of dissonance and thus a complete agreement. A value of 100% represents total dissonance, and thus complete disagreement. A value between these extremes represents the degree of agreement. For this paper, however, we have chosen to use the actual entropy values for comparison.

Since this survey contains the results of the perceptions of the respondents, whether or not the respondents support a particular topic, we wish to determine which of the topics t are most in agreement. Once we have ordered all the distributions according to their degree of dissonance, we can then investigate the specific values in each distribution to ascertain the level of support the respondents have given to a particular topic.

3.5 Ranking of Distributions

Recall that the Section I survey questions dealt with the percentage of time one actually spent on each of the traditional Systems Analysis and Design topics using the topics taught choices. The entropy result for each question is graphically displayed in Figure 1 and listed in Table I. Similarly, section II questions are attached as Appendix C, and the section III questions as Appendix D. The X-axis in the figure is labeled "element," a value associated with each question in the survey associated with the section under evaluation. In this case we deal only with the Section I questions. The relative entropy is calculated for each question in that section, then those values are sorted from high to low, that is, from the questions for which there is the least agreement to those whose agreement is greatest. Thus, element 1 in section 1 is actually survey question 3. We observe that survey question 3 (see Appendix A) refers to "What portion of your class is devoted to object-oriented analysis?" We see that for this question there is the least amount of agreement or agreement and hence, the entropy for that question is quite high. The actual values for this question are:

none	<5 %	5-10 %	11-15 %	16-20 %	21-25 %	25-50 %	>=50 %
5	6	5	4	4	1	2	3

We see that the responses cover the distribution and hence, we can infer little! Obviously there are some at the right end who consider their courses to be essentially object-oriented in nature, and others on the left who do little or nothing with it. At the opposite end, as shown in figure one as element 22, is survey question 18, "What percentage of your course is devoted to state-transition diagramming?" The distribution is:

none	<5%	5-10%	11-15%	16-20%	21-25%	25-50%	>=50%
11	15	4					

It is evident that something of a modest agreement does exist here, for most of the responses are on the left. Appendix B places each question, with the responses, in order.

4. ENTROPY GROUPINGS

The degree of separation between entropy measures allows us to map topics into natural groupings. The entropy listings under Table 1 show the percent difference from element n and n-1. Thus element 1 in the Table has a value that is 20% greater than element 2. Distributions possessing little information change can be mapped to a group of topics. Upon visual inspection we determine that a difference of 4% or more appears to be a suitable value to distinguish groups, and that allows us to partition the Section I response distributions into six groups (from highest to lowest entropy):

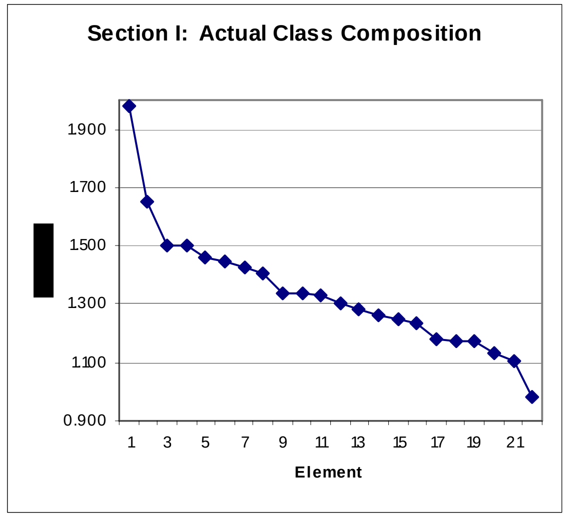

Figure 2 Ranking of IS topics by entropy.

Element	Survey Ques	*Entropy*	*Diff*
1	3	1.979	20.0%
2	2	1.649	9.7%
3	8	1.504	0.3%
4	6	1.499	2.5%
5	7	1.463	1.0%
6	23	1.448	1.5%
7	11	1.427	1.7%
8	14	1.403	4.9%
9	4	1.338	0.1%
10	20	1.336	0.4%
11	21	1.330	2.2%
12	13	1.302	1.5%
13	19	1.283	1.6%
14	12	1.262	0.9%
15	9	1.251	1.2%
16	15	1.236	4.8%
17	16	1.179	0.6%
18	10	1.172	0.0%
19	5	1.172	3.8%
20	17	1.129	2.3%
21	22	1.104	12.3%
22	18	0.983	

Table 1 Entropy measures for Section I questions.

1. Element 1 (survey question 3),
2. Element 2 (survey question 2),
3. Elements 3 – 8 (survey questions 8, 6, 7, 23, 11 and 14)
4. Elements 9 – 16 (survey questions 4, 20, 21, 13, 19, 12, 9, and 15)

5. Elements 17 – 21 (survey questions 16, 10, 5, 17, and 22)
6. Element 22 (survey question 18).

If the data had been more complex, we would have used a clustering algorithm to determine the groups, but the partitions in this data set are straightforward enough to be constructed visually.

The table below shows the entropy groupings and their associated ranges (highest group entropy minus lowest group entropy). The element column corresponds to the value of the x-axis in Figure 1 and the range is the difference between the highest and lowest entropies in a group.

Group	*Element*	*Survey Ques*	*Entropy*	*Range*
1	1	3	1.979	0
2	2	2	1.649	0
3	3-8	8	1.504	0.101
		6	1.499	
		7	1.463	
		23	1.448	
		11	1.427	
		14	1.403	
4	9-16	4	1.338	0.102
		20	1.336	
		21	1.330	
		13	1.302	
		19	1.283	
		12	1.262	
		9	1.251	
		15	1.236	
5	17-21	16	1.179	0.075
		10	1.172	
		5	1.172	
		17	1.129	
		22	1.104	
6	22	18	0.983	0

Table 2 Analysis of the Section I topics by entropy group.

4.1 Section I Descriptions of Responses

Based on the distribution of responses for each question, we offer the following analysis. Recall that Group 1 represents the largest entropy and hence, the least agreement. The agreement is fuzziest with group 1 and becomes more crisp with group 6, where the agreement is greatest.

Group 1

- *Object-oriented analysis* – There is the least amount of agreement on the responses with responses being distributed in every category. It does show that the expected shift in the curriculum from traditional to object-oriented has begun.

Group 2

- *Structured analysis* – half of respondents spend leas than 20% on this topic, and the other half spend more than 25% on it. It appears that structured analysis is perceived as being important since all devote at least some of their class to the topic.

Group 3

- *Data modeling in general* – 40% devote 5-10% of course time to this topic, one respondent devotes no time to it, and 37% devote more than 10% of class time to it. It is inferred that this topic is important enough to be included.
- *Project management concepts* – 13% devote no time to it, but 80% devote up to 15% of course time to this topic.
- *Systems methodologies* – 40% at least mention the topic, and another 40% spend 5-15% of course time on it.
- *Program design* – 24% devote no time to this topic, one respondent devotes more than half the course to it, and 41% devote less than 5% to it.
- *Process modeling in general* – the majority of respondents (50%) devote 5-10% of the course time to this topic. Ten percent devote up to half the course time to it.
- *Use case* – 1/3 of the respondents devoted no time to this topic, and 43% mention it.

Group 4

- *Systems analysis overview* – every respondent devoted at least some time to it, 40% touched on the topic, 50% devoted 5-15% of course time to it, and 10% devote up to 50% of the course to this topic.
- *Systems design concepts in general* – everyone devotes at least some time to this topic, with 70% devoting up to 10% of course time to it.
- *Interface design* – 1% devote nothing to this topic, but 73% devote up to 10% of the course to it.
- *Decomposition diagramming* – 80% devote at least some time to this topic, and 7% of respondents devote 21-50% of course time to it.
- *Cost benefit and payback analysis* – 77% of respondents devote up to 10% of the course time to this topic.
- *DFD* – one respondent devoted no time to this topic, but the majority of respondents (53%) devoted 5-10% of the course to it.

- *ER diagrams* – 77% devote some time to this topic, with 56% devoting 5-15% of the course to it. Only one respondent (3%) devoted no time to it.
- *UML* – 43% devote no time to this topic, 50% devote modest time to it, and 7% devote more than 50% of the course to it.

Group 5

- *Class diagramming* – 38% devote no time to this topic, but 55% devote at least some time to it.
- *Normalization concepts* – 70% at least mention this topic, though 23% devote no time to it.
- *Project initiation and data collection* – 60% devote 5-15% of their time to this topic, but 13% devote more time.
- *Sequence diagramming* – 83% devote little or no time, but 1% do devote modest time (11-15% of the course).
- *File and database design* – 83% devote at least some time to it.

Group 6

- *State-transition diagramming* – 87% devote little or no time to the topic.

4.2 Section I Analysis

With the small sample size it is always dangerous to attempt to form meaningful conclusions, but we feel compelled to make some observations about this analysis. We have partitioned the distributions, based on the entropy measures, into three categories: topics that are generally avoided by IS instructors, topics that generally included by IS instructors, and those topics which may or may not be included. Those topics in the group generally avoided are: state-transition diagramming, file and database design, sequence diagramming, normalization, class diagramming, and UML. Those topics in the generally included group are: system design concepts in general, overview of systems analysis, process modeling in general, project management concepts, data modeling in general, and structured analysis. Those topics that cannot be placed in either of these two previous groups are: project initiation and data collection analysis, entity relationship diagrams, data flow diagramming, cost-benefit and payback analysis, decomposition diagramming, interface design, use case, program design, and systems methodologies. Because of high entropy and the appearance of the distribution, we are unable to place object-oriented analysis in any category at the present time.

5. SECTION II DISCUSSION

This set of questions dealt with the perceived importance of topics and asked respondents to rank them as definitely important, somewhat important, undecided, somewhat unimportant, and definitely unimportant. The entropy measures are displayed in order of decreasing values (Figure 2), and the difference between contiguous entropy values is provided in Table 3. The selection of entropy groups is similar to the Section I questions in that the differences between contiguous entropy values allows us to easily select the groups. Thus, we select elements 1 and 2 to be group 1, elements 3-6 as group 2, elements 7-11 as group 3, element 12 as group 4, and element 13 as group 5. We begin the analysis of this set of questions with the lowest entropy values, for they represent the response distributions that possess the least amount of dissonance and thus the greatest amount of agreement or agreement, among the respondents. The Section II survey questions, ordered by entropy value, are contained in Appendix C.

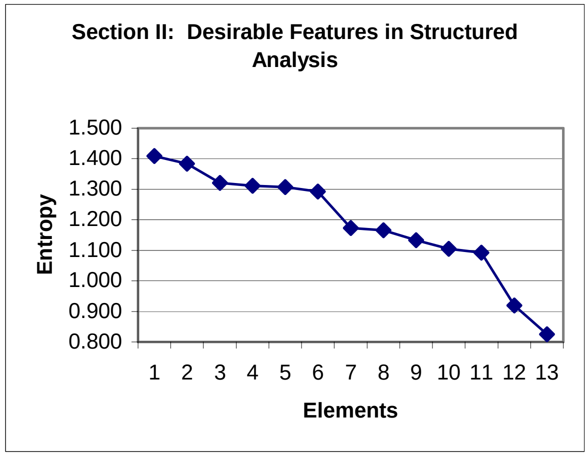

Figure 3 Section II entropy values ordered high to low.

Element	Survey Ques	Entropy	Diff
1	35	1.408	1.8%
2	30	1.383	4.7%
3	36	1.320	0.7%
4	33	1.312	0.4%
5	32	1.307	1.1%
6	26	1.293	10.2%
7	34	1.173	0.6%
8	29	1.166	2.9%
9	31	1.133	2.5%
10	28	1.105	1.2%
11	25	1.092	18.8%
12	24	0.919	11.4%
13	27	0.826	

Table 3 Entropy measures for Section II questions.

5.1 Section II Analysis

We expected that most individuals would identify the topics in this section as being either definitely important or at least somewhat important, so we expected the distributions to be skewed. It was a surprise, however, to see the number of responses in the undecided category, ranging from zero to nine. In fact, question 30 is a problem in itself in that the undecided vote has the same value as the "somewhat important" category (see appendix C).

In examining the individual distributions we note that the **teaching of data flow diagrams** is in greatest agreement with 73% of respondents checking the "definitely important" category. Teaching modeling concepts drops to 69% of respondents saying it is "definitely important," but one respondent (4%) selected "definitely unimportant." This is rather troubling, for Systems Analysis and Design deals specifically with the art and science of modeling business processes and activities. We suspect the respondent misread the question, but, because that survey was received without instructor identification (the email address was optional), we were unable to follow up.

From the perspective of agreement, the following topics have been identified as being definitely important:

- Dfd's
- Data modeling concepts
- Erd's
- Balancing dfd's
- Project that uses both data and process modeling skills
- Team project

Those topics that are predominantly "somewhat important" are:

- Decomposition diagramming
- Skill in data collection, surveying, and interviewing
- Use of a CASE tool
- Interviewing techniques

Every question elicited at least one "unimportant" response. However, question 34 (complete a team project), question 32 (project management skills), and question 30 (activity dependency diagrams) all had 20% of responses in the "unimportant" category. Question 36 (use of a CASE tool) had 24% of respondents identifying it as "unimportant," and question 35 (interviewing techniques) had 27% classifying it as "unimportant."

Question 26 (model data to the 3rd normal form) was split between "definitely" and "somewhat important" equally at 37% each, giving 74% to the "important" category. While the percentages appear significant, recall that N is rather small! The reader is urged to use caution on how best to utilize this information in the design of class content.

6. SECTION III DISCUSSION

This last section dealt predominantly with object-oriented analysis (see appendix D) and mapped out to three entropy groups (figure 3). Responses to this set of questions was limited only those educators who taught OOA. The graph and table are displayed below. Note that element six is in greatest agreement with respect to the distribution of responses, with a low entropy of 1.137. The lowest entropy values for section I and section II questions are 0.983 and 0.826, respectively, and hence the 1.137 shows a marked lack of agreement, but each set of questions was presented as specific groups, so the analysis should follow the same format. We select element 1 as group 1, elements 2-5 as group 2, and element 6 as group 3.

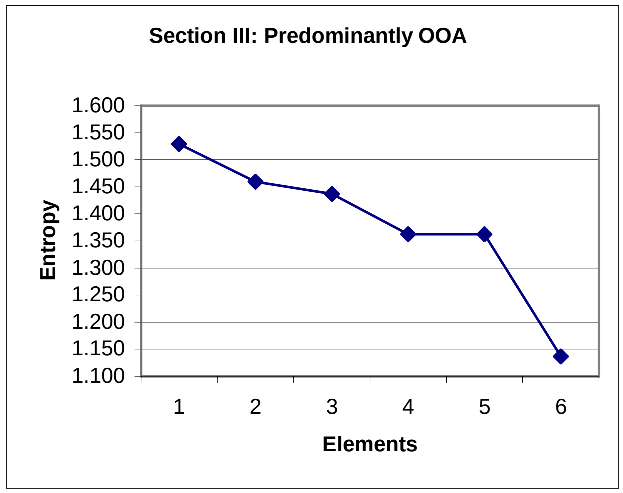

Figure 4 Section III ordered entropy values.

Element	Survey Ques	*Entropy*	*Diff*
1	38	1.529	4.8%
2	39	1.459	1.6%
3	40	1.437	5.5%
4	41	1.362	0.0%
5	42	1.362	19.8%
6	37	1.137	

Table 4 Entropy measures for Section III questions.

6.1 Section III Analysis

According to those who teach OOA there is dissonance in the responses in all six questions. The analysis by group follows:

Group 1

- Class diagramming – 57% denote it as "definitely important" and 21% as unimportant.

Group 2
- Use of a model-based software tool – 50% checked "important" and 43% checked "unimportant."
- Cost-benefit analysis – 79% checked "important" and 21% "unimportant."
- Project management skills – 64% checked "important" and 21% "unimportant."
- State-transition diagramming – 44% checked "important" and 24% "unimportant."

Group 3
- Sequence diagramming – 50% checked "important" and 29% "unimportant."

There was too much variation in the section III distributions as reflected in the entropy measures. We interpret the dissonance to the fact the OOA method is not yet mainstream; it is reasonable to expect that as the discipline matures, the level of agreement will increase.

7. SUMMARY OF RECOMMENDATIONS AND CONCLUSIONS

Educators involved in the teaching of the Systems Analysis and Design course have identified a limited agreement with respect to a specified set of topics taught in the Systems Analysis and Design course. Using the Shannon Entropy as a measure of agreement the topics have been partitioned into a series of groups based on the relative entropy measure calculated on the questions associated with each of the three sections. This method allows us to rank the distributions based on the entropy. We interpret the minimum entropy as being the distribution with the greatest degree of agreement, and the largest entropy with the greatest degree of disagreement among the respondents.

Sharing an entropy group does not represent an equivalence among topics but rather, a agreement as to what is, or is not, currently being taught (Section I). An item having the lowest entropy, and thereby the greatest consensus or agreement, may be an item that is taught least. This is exactly the case in Section I in which the distribution with the minimal entropy (i. e., question 18) represents a topic that is taught least (state-transition diagramming). On the other hand, element 9 in group 4 of section I (see section 4) represents almost the midpoint in the distribution with respect to entropy, but the question deals with the percentage of the course devoted to teaching dfd's, and the numbers suggest that almost all IS instructors identify it as being important, but there is lesser agreement in the amount of time to devote to the teaching of the subject.

With respect to the questions in Section II, the respondents' rank the ability to draw a dfd as being very important, and interviewing techniques is ambiguous at best. The entropy for the interviewing techniques question is highest in that section of questions, showing the least agreement.

Finally, Section III questions deal with OOA, and the entropy for all the distributions is rather high. We conclude that IS educators have not yet moved to OOA, either in instruction or in importance.

The strongest agreement was concerned with the topic of data flow diagramming and data modeling, and the agreement is that these topics are definitely important, however, most IS educators devoted little time to that topic. The reason for this dichotomy is addressed in another paper.

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AUTHOR BIOGRAPHIES

William J. Tastle is an associate professor of information systems in the School of Business at Ithaca College, where he is the coordinator of the MIS program. Previously he chaired the computer science unit of the department of mathematics and computer science. He is the Managing Editor of the International Journal of General Systems and the Past President of the Association of Information Technology Professionals, Special Interest Group on Education. His research specialty is reconstructability analysis and the analysis of complex systems. He has received best paper awards from both ISECON and IBSCUG. Currently, he is completing a text on business process modeling.

Jack Russell is the NSU CIS Coordinator and is Professor of Computer Information Systems at NSU. He holds a Ph.D. from the University of North Texas, an M.S. in Computer Science from Florida Institute of Technology, and the CCP (Certified Computer Professional) from the Institute for the Certification of Computer Professionals (ICCP). Prior to coming to NSU Dr. Russell was a Regents Professor with the Texas A&M University System and was named Piper Professor of Texas in 1997 by the Minnie Stevens Piper Foundation. Dr. Russell has published works in various business journals and proceedings; and is the author of a leading text titled *Business Programming Logic and Design*. Dr. Russell serves as Regent with the AITP National Education Foundation and as Director for the Institute for Certification of Computer Professionals (ICCP) Education Foundation. He is past-president of the AITP EDSIG and has coached and sponsored numerous national winners in various computer-related events.

Appendix A
Survey of Skills Perceived as Important in Systems Analysis and Design

1A Name of college/university (optional):
1B Your current academic rank:
1C Total number of years in college-level teaching:
1D Level of Systems Analysis & Design course (or other similar course) taught:

Section I: PICK ONE COURSE THAT MOST CLOSELY APPROXIMATES THE SYSTEMS ANALYSIS/DESIGN COURSE.
If you teach both UG and G, limit answers to the UG course.

1. What is the **percentage of time** spent on each of these traditional Systems Analysis and Design topics?
2 What portion of your class is devoted to **structured analysis**?
3 What portion of your class is devoted to **object-oriented analysis**?
4 What percentage of your course is devoted to an **overview** of the Systems Analysis process?
5 What percentage of your course is devoted to **project initiation and data collection** analysis?
6 What percentage of your course is devoted to **project management** concepts (function point analysis, estimating person months, project length, Gant charts, automated project estimation tools, etc.)?
7 What percentage of your course is devoted to an **overview of the various systems methodologies** (waterfall, phased, parallel, prototyping, throw-away prototyping, structured analysis, information engineering, etc.)?
8 What percentage of your course is devoted to **data modeling** in general?
9 What percentage of your course is devoted to **entity relationship** diagrams?
10 What percentage of your course is devoted to **normalization** concepts?
11 What percentage of your course is devoted to **process modeling** in general?
12 What percentage of your course is devoted to **data flow diagramming**?
13 What percentage of your course is devoted to **decomposition diagramming**?
14 What percentage of your course is devoted to **use case**?
15 What percentage of your course is devoted to **UML**?
16 What percentage of your course is devoted to **class diagramming**?
17 What percentage of your course is devoted to **sequence diagramming**?
18 What percentage of your course is devoted to **state-transition diagramming**?
19 What percentage of your course is devoted to **cost-benefit and payback analysis**?
20 What percentage of your course is devoted to **systems design concepts** in general?
21 What percentage of your course is devoted to **interface design**?
22 What percentage of your course is devoted to **file and database design**?
23 What percentage of your course is devoted to **program design**?

Section II: If you DO teach structured analysis concepts that include entity-relationship diagrams, decomposition and dataflow diagrams, answer the following questions. If NOT, skip to Section III.

24 Teaching data modeling concepts is:
25 Teaching students to draw entity relation diagrams is:
26 Teaching students to normalize a data model at least to the 3rd normal form is:
27 Teaching students to draw a complete data flow diagram is:
28 Teaching students to balance a data flow diagram is:
29 Teaching students to draw a decomposition (process hierarchy diagram is:
30 Teaching students to draw an activity dependency diagram is:
31 Teaching students to complete a project that requires the use of both data and process modeling skills is:
32 Requiring students to complete a project that requires project management skills is:
33 Requiring students to learn data collection, survey, and interviewing skills is:
34 Requiring students to complete a project as a team is:
35 Requiring students to actually exercise interviewing techniques is:
36 Requiring students to use a CASE tool to implement a business model is:

Section III: If you teach BOTH structured analysis AND OOA, or if you are predominantly using OOA, answer these questions.

37 Teaching students to use class diagramming is:
38 Teaching students to use sequence diagramming is:
39 Teaching students to use state-transaction diagramming is:
40 Requiring students to complete an entire object model using project management skills is:
41 Teaching students to perform cost-benefit analysis is:
42 Teaching students to use a model-based software tool to implement a design is:

Section IV: These questions deal with the use of CASE or model-based tools.

43 What CASE tool or other model-based software do you use in conjunction with your systems class?
43A If question 43 above is "other tool," please specify:

Appendix B
Section I Questions and Responses Ordered by Entropy (Low to High)

18. What percentage of your course is devoted to state-transition diagramming?

none	<5%	5-10%	11-15%	16-20%	21-25%	25-50%	>=50%
11	15	4					

22. What percentage of your course is devoted to file and database design?

none	<5%	5-10%	11-15%	16-20%	21-25%	25-50%	>=50%
4	12	13	1				

17. What percentage of your course is devoted to sequence diagramming?

none	<5%	5-10%	11-15%	16-20%	21-25%	25-50%	>=50%
14	11	2	3				

5. What percentage of your course is devoted to project initiation and data collection analysis?

none	<5%	5-10%	11-15%	16-20%	21-25%	25-50%	>=50%
1	7	9	9	3	1		

10. What percentage of your course is devoted to normalization concepts?

none	<5%	5-10%	11-15%	16-20%	21-25%	25-50%	>=50%
7	15	6	2				

16. What percentage of your course is devoted to class diagramming?

none	<5%	5-10%	11-15%	16-20%	21-25%	25-50%	>=50%
11	12	4	2				

15. What percentage of your course is devoted to UML?

none	<5%	5-10%	11-15%	16-20%	21-25%	25-50%	>=50%
13	9	6					2

9. What percentage of your course is devoted to entity relationship diagrams?

none	<5%	5-10%	11-15%	16-20%	21-25%	25-50%	>=50%
1	11	12	5	1			

12. What percentage of your course is devoted to data flow diagramming?

none	<5%	5-10%	11-15%	16-20%	21-25%	25-50%	>=50%
1	4	16	4	1	1		

19. What percentage of your course is devoted to cost-benefit and payback analysis?

none	<5%	5-10%	11-15%	16-20%	21-25%	25-50%	>=50%
4	15	8	1	2			

13. What percentage of your course is devoted to decomposition diagramming?

none	<5%	5-10%	11-15%	16-20%	21-25%	25-50%	>=50%
2	13	11	2		1	1	

21. What percentage of your course is devoted to interface design?

none	<5%	5-10%	11-15%	16-20%	21-25%	25-50%	>=50%
3	12	10	4	1			

20. What percentage of your course is devoted to systems design concepts in general?

none	<5%	5-10%	11-15%	16-20%	21-25%	25-50%	>=50%
	11	8	5	2	1		

4. What percentage of your course is devoted to an overview of the Systems Analysis process?

none	<5%	5-10%	11-15%	16-20%	21-25%	25-50%	>=50%
	12	9	6		1	2	

14. What percentage of your course is devoted to use case?

none	<5%	5-10%	11-15%	16-20%	21-25%	25-50%	>=50%
10	13	3	2	1	1		

11. What percentage of your course is devoted to process modeling in general?

none	<5%	5-10%	11-15%	16-20%	21-25%	25-50%	>=50%
	7	15	3	2		3	

23. What percentage of your course is devoted to program design?

none	<5%	5-10%	11-15%	16-20%	21-25%	25-50%	>=50%
7	12	2	6		1		1

7. What percentage of your course is devoted to an overview of the various systems methodologies (waterfall, phased, parallel, prototyping, throw-away prototyping, structured analysis, information engineering, etc.)?

none	<5%	5-10%	11-15%	16-20%	21-25%	25-50%	>=50%
2	12	9	3	3	1		

6. What percentage of your course is devoted to project management concepts (function point analysis, estimating person months, project length, Gant charts, automated project estimation tools, etc.) ?

none	<5%	5-10%	11-15%	16-20%	21-25%	25-50%	>=50%
4	8	9	7	2			

8. What percentage of your course is devoted to data modeling in general?

none	<5%	5-10%	11-15%	16-20%	21-25%	25-50%	>=50%
1	6	12	7	2	2		

2. What portion of your class is devoted to structured analysis?

none	<5%	5-10%	11-15%	16-20%	21-25%	25-50%	>=50%
	1	5	6	3		6	9

3. What portion of your class is devoted to object-oriented analysis?

none	<5%	5-10%	11-15%	16-20%	21-25%	25-50%	>=50%
5	6	5	4	4	1	2	3

Appendix C:
Section II Questions and Responses Ordered by Entropy (Low to High)

27. Teaching students to draw a complete data flow diagram is:

Def important	Somewhat imp	Undecided	Somewhat unimp	Definitely unimp
19	5	1	1	

24. Teaching data modeling concepts is:

Def important	Somewhat imp	Undecided	Somewhat unimp	Definitely unimp
18	5	2		1

25. Teaching students to draw entity relation diagrams is:

Def important	Somewhat imp	Undecided	Somewhat unimp	Definitely unimp
12	10	3	1	

28. Teaching students to balance a data flow diagram is:

Def important	Somewhat imp	Undecided	Somewhat unimp	Definitely unimp
13	9	2	2	

31. Teaching students to complete a project that requires the use of both data and process modeling skills is:

Def important	Somewhat imp	Undecided	Somewhat unimp	Definitely unimp
12	10			4

29. Teaching students to draw a decomposition (process hierarchy diagram is:

Def important	Somewhat imp	Undecided	Somewhat unimp	Definitely unimp
7	14	3	2	

34. Requiring students to complete a project as a team is:

Def important	Somewhat imp	Undecided	Somewhat unimp	Definitely unimp
14	5	1	1	4

26. Teaching students to normalize a data model at least to the 3rd normal form is:

Def important	Somewhat imp	Undecided	Somewhat unimp	Definitely unimp
10	10	2	1	3

32. Requiring students to complete a project that requires project management skills is:

Def important	Somewhat imp	Undecided	Somewhat unimp	Definitely unimp
10	9	1	2	3

33. Requiring students to learn data collection, survey, and interviewing skills is:

Def important	Somewhat imp	Undecided	Somewhat unimp	Definitely unimp
7	13	3	1	3

36. Requiring students to use a CASE tool to implement a business model is:

Def important	Somewhat imp	Undecided	Somewhat unimp	Definitely unimp
3	12	2	2	6

30. Teaching students to draw an activity dependency diagram is:

Def important	Somewhat imp	Undecided	Somewhat unimp	Definitely unimp
3	9	9	4	1

35. Requiring students to actually exercise interviewing techniques is:

Def important	Somewhat imp	Undecided	Somewhat unimp	Definitely unimp
5	11	3	4	3

Appendix D:
Section III Questions and Responses Ordered by Entropy (Low to High)

37. Teaching students to use class diagramming is:

Def important	Somewhat imp	Undecided	Somewhat unimp	Definitely unimp
8		3	1	2

42. Teaching students to use a model-based software tool to implement a design is:

Def important	Somewhat imp	Undecided	Somewhat unimp	Definitely unimp
2	5	1	5	1

41. Teaching students to perform cost-benefit analysis is:

Def important	Somewhat imp	Undecided	Somewhat unimp	Definitely unimp
5	6		2	1

40. Requiring students to complete an entire object model using project management skills is:

Def important	Somewhat imp	Undecided	Somewhat unimp	Definitely unimp
4	5	2	2	1

39. Teaching students to use state-transisiton diagramming is:

Def important	Somewhat imp	Undecided	Somewhat unimp	Definitely unimp
3	6	2	2	1

38. Teaching students to use sequence diagramming is:

Def important	Somewhat imp	Undecided	Somewhat unimp	Definitely unimp
4	3	3	3	1

Appendix E

	A	B	C	D	E	H(X)	Relative H	Mean	STDEV
1	10	0	0	0	0	0.000	0.00%	2	4.472
2	0	0	20	0	0	0.000	0.00%	4	8.944
3	0	0	0	0	50	0.000	0.00%	10	22.361
4	0	15	20	0	0	0.985	42.43%	7	9.747
5	1	0	1	0	1	1.585	68.26%	1	0.548
6	5	0	5	0	5	1.585	68.26%	3	2.739
7	50	0	50	0	50	1.585	68.26%	30	27.386
8	1	0	0	0	0	0.000	0.00%	0	0.447
9	1	2	0	0	0	0.918	39.55%	1	0.894
10	1	2	3	0	0	1.459	62.84%	1	1.304
11	1	2	3	4	0	1.846	79.52%	2	1.581
12	1	2	3	4	5	2.149	92.56%	3	1.581
13	50	50	50	50	50	2.322	100.00%	50	0.000
14	1	2	3	4	5	2.149	92.56%	3	1.581
15	9	7	5	3	1	2.062	88.81%	5	3.162
17	5	5	5	5	5	2.322	100.00%	5	0.000
18	20	21	22	21	20	2.321	99.96%	21	0.837
19	20	30	40	30	20	2.271	97.80%	28	8.367
20	2	3	50	3	2	0.979	42.14%	12	21.249

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