

Does Coalescent Knowledge Exist?

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ABSTRACT

The coalescent knowledge theory was first presented at the Academy of Management - Management Consulting Division's first international conference in Lyon, France in March 2001. This knowledge theory embraces shared knowledge, which exists between two or more people, and can be used to increase the flexibility of an organization to transfer knowledge within an organizational structure. Coalescent knowledge is created via reading documents and dialogue with or demonstration (action) by other people. Using the data that was collected to prove empirically that Polanyi's tacit knowledge does exist, a study was conducted to determine if the coalescent knowledge dimension exists. The results indicated that the coalescent knowledge dimension does also exist, with an effect size greater than 1.0 [one-tail t-Test - alpha = 0.05].

INTRODUCTION

Overview

This paper provides a literature review that establishes the foundation and understanding of the coalescent Knowledge dimension (shared knowledge). The literature review includes tables of the characteristics and graphical representations of this theory. A search was performed to determine if empirical research had been performed on this knowledge dimension. No evidence of empirical research was found. The primary research question addressed in this paper is: Does coalescent knowledge exist?

Knowledge theory papers written by various scholars use knowledge and knowing interchangeably. In this paper, these words will have the same meaning.

A REVIEW OF COALESCENT KNOWLEDGE LITERATURE

Coalescent Knowledge Dimension

Morgan, Merino, Morabito, and Reilly first proposed the coalescent knowledge dimension at the Academy of Management - Management Consulting Division's first international conference in Lyon, France in March 2001. In 2004, Morgan, Morabito, & Merino presented a paper at the Academy of Management Annual Meeting in New Orleans, applying the coalescent knowledge concept to facilitate the creation of actionable knowledge in an organization, thus creating a competitive advantage. In 2008, Morgan presented a paper at the Academy of Management Annual Meeting on "Creating a Graphical Three (3) Dimensional Diagram of the Knowledge Transfer Process". In this paper, coalescent knowledge provides the dimension that is used to create shared knowledge between two or more people to facilitate the transfer of tacit and explicit knowledge.

The coalescent knowledge theory has evolved over time and is based on the fact that a person lives in a world that has at least four dimensions and a person's knowledge has four (4) dimensions as well. One of the dimension is Polanyi's (1958, 1966) Tacit knowledge dimension, which now has a proof of theory (Morgan, 2008). Tacit is the knowledge a person uses but is not aware that they are using. Therefore, it is un-expressible. Another dimension is the explicit knowledge dimension (Plato 384-322 BC). Explicit is the knowledge that a person knows (is aware) they possess and it is always linked to tacit knowledge. This knowledge is considered by some to be information when it is externalized by writing a document, etc. In this case, the document is explicit knowledge to the writer and information to the reader, which makes it individual knowledge. In the history of western thought, explicit knowing has received thorough treatment (Gill, 2000). In modern times, Polanyi devoted a majority of his work to the interplay between the explicit and tacit components of human experience (Gill, 2000). Time is a dimension that is always there. The last dimension is coalescent knowledge. This knowledge that is shared between two or more people. The coalescent dimension increases the total knowledge dimensions that a person uses to interact with their environment to four (4).

Morgan (2008) provides the following description of coalescent knowledge. "It is shared knowledge that exists between two or more people. Some form of dialogue and/or observation creates this shared knowledge. A scenario of coalescent knowledge creation would be two people discussing a method of splitting wood to burn in a stove or fireplace. In this process, the first person instructs the second person on how to split wood by demonstration and dialogue. The second person links this information to their knowledge and does an integration of the

information into their knowledge base. In the next step, the second person confirms with the first person the understanding of how to split wood by demonstrating the splitting of wood with an axe. The process continues until both people agree that the second person has the knowledge set needed to split wood. This process has created a shared knowledge that only exists between the two people involved in the dialogue. Since it is shared and expressible in words and action, this knowledge does not meet the definition for Polanyi's tacit or explicit knowledge. Morgan, Merino, Morabito, and Reilly (2001) concluded that if this shared knowledge did not link to the definitions of tacit and explicit knowledge, then it must reside in a new knowledge dimension that is shared. They searched for a word to describe this dimension and selected coalescent. It is defined as coming together to form a new whole. The coalescing of knowledge of two or more people has created a new-shared knowledge that is expressible in words and/or action. A graphical representation of the knowledge created is presented in Figure 1.

Graphical Representation of Coalescent Knowledge

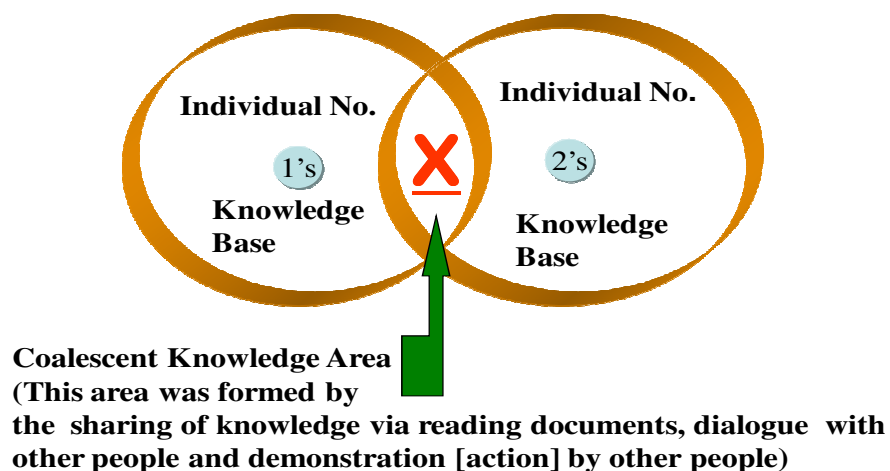


Figure 1

The coalescent knowledge dimension has the following characteristics:

- Shared
- Expressible by words and/or action
- Private or Public
- Scalable (2 + people)
- Facilitates the opportunity for individuals to act as if they have one mind”

METHODS

Research Hypothesis

Does the coalescent knowledge dimension exist? To answer this question, we can hypothesize that coalescent knowledge dimension does NOT exist, and then perform research to test this assertion. The null hypothesis is:

Hypothesis 1. Coalescent knowledge dimension does NOT exist

The testing of this null hypothesis requires an answer to the following question. How does one measure this shared knowledge? The key to measuring it is that it comes from other people via reading documents, dialogue, and demonstration (action) and **NOT** from **self** through observation, experimentation, reasoning, or indwelling. Therefore, to test for the existence of the coalescent knowledge dimension, the source of a person’s knowledge must be determined.

reflection, the respondent provides the primary source of their knowledge for each hypothesis-linked question.

The subjects used to test the survey instrument meet all the criteria for survey respondent requirements, except for one. The test subjects were not Stevens Institute of Technology, Howe School of Technology Management students. The test subjects took the survey. After completing the survey, they were debriefed to provide feedback on any problems with the reading, interruptions, and answering of questions. Based on the test results, the survey was revised and retested until all of the issues were eliminated.

The issue of survey respondents not remembering the primary source of knowledge that the survey questions asked about was a concern during the testing and the actual study. It should be noted that the survey did not require the respondents to indicate who was the source of the knowledge other than the three categories to be checked. In place of using an X to indicate a selection of a category, 24 % of the respondents used the name (mother, father, teacher, uncle, etc.) of the source.

The following is the sample question that was included in the survey:

1.0 Beliefs = A set of understandings that reflect our perspective of the world; an acceptance of something as true.

Given the following belief: **The sun will rise in the morning.**

1.1 Do you believe that the sun will rise in the morning? Yes No (Circle One)

1.2 How long have you had this belief? _____ Year(s)

1.3 Please place an X next to the primary source of knowledge about this belief:

Documents _____	Self _____	Others _____
(Text, Pictures, etc.)	(You decided that it was true)	(Mother, Father, Teacher, etc.)

The gathering of personal data on values, beliefs, etc does have the potential of having some bias in the responses. To reduce response bias the respondents were told that there are “**No**” correct answers to the survey questions. Examples and/or definitions (i.e. 1.0 beliefs definition) were used to achieve a standard understanding of the terms and question structure across all respondents to reduce method variance between respondents. (Podsakoff & Organ, 1986), (Podsakoff, MacKenzie, Lee & Podsakoff, 2003) Questions 1.1 through 1.2 were used to stimulate the cognitive process prior to the hypothesis linked question, the respondents were asked one or two questions regarding the knowledge being measured. This additional cognitive activity should reduce the covariance in the study. (Podsakoff, et al., 2003)

In question 1.3, the primary source of the respondents belief on **The sun will rise in the morning**, the survey respondent’s were instructed to evaluate the three (3) alternatives based on the logic provided and to choose one of the three alternatives as the primary source of their knowledge about the belief . The requested selection can take place no matter what the answer is in question 1.1 and 1.2. To evaluate the three (3) alternatives, the respondents were instructed to use the definition of beliefs provided as well as the following logic. If the source of the knowledge is Documents (text, pictures, etc) and the respondent accepts the document statement that the belief is true, then select Documents. If the source is Others (mother, father, teacher,

etc.) and the respondent accepts the statement as true, then select Others. If the source is Documents or Others, but the respondent (Self) determines that the belief is true via observation, experimentation, reasoning, indwelling, etc, then select Self. If the respondent determined on their own via observation, experimentation, reasoning, indwelling, etc the belief to be true, then select Self.

Sample Size Determination

If coalescent knowledge dimension theory is correct and the theory applies to all of the people, then the smallest effect size worth detecting is medium (0.5 per Cohen, 1988). Therefore, an effect size (0.50) was used to calculate the sample size requirement (N) to ensure that there is 90 % probability of correctly rejecting a False H_0 . This probability value is called Power.

- Power: $\delta = \gamma \sqrt{N}$ (Howell , 1999 [Table lookup])
- Sample size: $N = (\delta/\gamma)^2$
- This Power calculation assumes a medium effect size of 0.50 and an alpha = .05, one-tail test
- Sample size: $N = (\delta/\gamma)^2 = (2.90/.50)^2 = 33.64$ (Howell, 1999)

This study requires a minimum of 33.64 subjects, who complete all items on the survey correctly. Because of the possibility of unrecoverable errors in completing the survey, the size of the sample was increased. If the error rate is no larger than 10%, then the minimum sample size should be 1.10 times $33.64 = 37.00$ or 37.

Target Population and Research Respondent Selection

The selected target population for conducting the survey was a group of graduate students attending the Stevens Institute of Technology, Howe School of Technology Management. The students participating in the survey were 18 years old or older and expressed a willingness to take a survey.

Definitions of Demographics and Control Variables

The survey respondents demographics were describe using the following variables:

- Age in years: 1 (18 - 29), 2 (30-39), 3 (40-49), 4 (50-59), 5 (60-69), 6 (70 or older)
- Sex: 1 (Female) & 2 (Male)
- Cultural background: 1 (Asian or Pacific Island); 2 (Black/African American); 3 (Hispanic/Latino); 4 (American Indian or Alaska Native); 5 (White/Caucasian); & 6 (Other)
- Highest level of education obtained: 1 (BA, BS or equivalent); 2 (Masters); & 3 (Doctorate)

In the case of the respondent demographic data collection, the items are verifiable through other sources. In principle, the respondent would not manipulate it for socially desirable reasons.

Therefore, this data is factually accurate. (Podsakoff & Organ, 1986)

Analysis Methodology

For the hypothesis analysis, recoding of the respondent's answers to the questions Belief (survey question 5.3), Value (survey question 6.3), Ideas (survey question 7.2), and Skill [Knowing How] (survey question 8.3) was required. The recoding was to address the hypothesis in the

analysis process directly. In the hypothesis analysis, we are only interested in the values for Others and Documents. The selection of Others or Documents was coded as a one (1) and Self was coded as a zero (0). When testing a proposition of the existence of the coalescent knowledge dimension, a mean significantly greater than zero (0) is required to reject the null hypothesis. Each question's data stream was tested for a mean of zero (0) (one-tail, α of 0.05) using T-Test methodology (Howell, 1999). **Since this research is a proof of theory, only one out of the four hypotheses linked questions greater than zero (0) is required to reject the null hypothesis.**

Hypothesis 1. Coalescent knowledge dimension does not exist

Question on Belief (5.3):

$H_0: \mu_{5.3} \leq 0$; Accept the Null Hypothesis

$H_1: \mu_{5.3} > 0$; Reject the Null Hypothesis

Question on Values (6.3):

$H_0: \mu_{6.3} \leq 0$; Accept the Null Hypothesis

$H_1: \mu_{6.3} > 0$; Reject the Null Hypothesis

Question on Ideas (7.2):

$H_0: \mu_{7.2} \leq 0$; Accept the Null Hypothesis

$H_1: \mu_{7.2} > 0$; Reject the Null Hypothesis

Question on Knowing How [Skill] (8.3):

$H_0: \mu_{8.3} \leq 0$; Accept the Null Hypothesis

$H_1: \mu_{8.3} > 0$ Reject the Null Hypothesis

When testing the proposition that the primary source of a person's knowledge is from the coalescent knowledge dimension, a mean significantly greater than 0.5 is required to reject the null hypothesis. In other words, 62.5 % of the survey respondents must select self to reject the null hypothesis on the hypothesis-linked questions. Each question's data stream will be tested for a mean of 0.5 (one-tail, α of 0.05) using T-Test methodology (Howell, 1999). Since this research is a proof of theory, only one hypothesis linked question greater than 0.5 is required to reject the null hypothesis:

*Hypothesis 2. The primary source of a person's knowledge is
NOT the coalescent knowledge dimension.*

Question on Belief (5.3):

$H_0: \mu_{5.3} \leq 0.5$; Accept the Null Hypothesis

$H_1: \mu_{5.3} > 0.5$; Reject the Null Hypothesis

Question on Values (6.3):

$H_0: \mu_{6.3} \leq 0.5$; Accept the Null Hypothesis

$H_1: \mu_{6.3} > 0.5$; Reject the Null Hypothesis

Question on Ideas (7.2):

$H_0: \mu_{7.2} \leq 0.5$; Accept the Null Hypothesis

$H_1: \mu_{7.2} > 0.5$; Reject the Null Hypothesis

Question on Knowing How [Skill] (8.3):

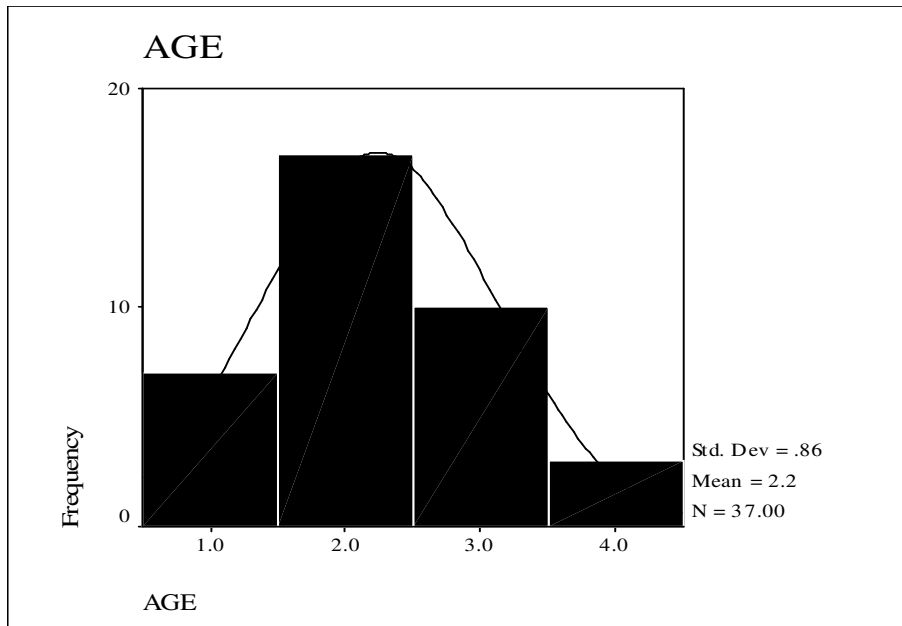
$H_0: \mu_{8.3} \leq 0.5$; Accept the Null Hypothesis

$H_1: \mu_{8.3} > 0.5$ Reject the Null Hypothesis

Analysis and Results

The study required a minimum of 34 respondents to complete the survey correctly. The actual number of surveys used in the study was 37. The selected target population for conducting the survey was the graduate students attending the Stevens Institute of Technology, Howe School of Technology Management. In fact, the students participating in the survey were all from the Executive Masters in Technology Management program. The following figures display the survey respondent's demographics for age, sex, cultural background, and highest level of education obtained:

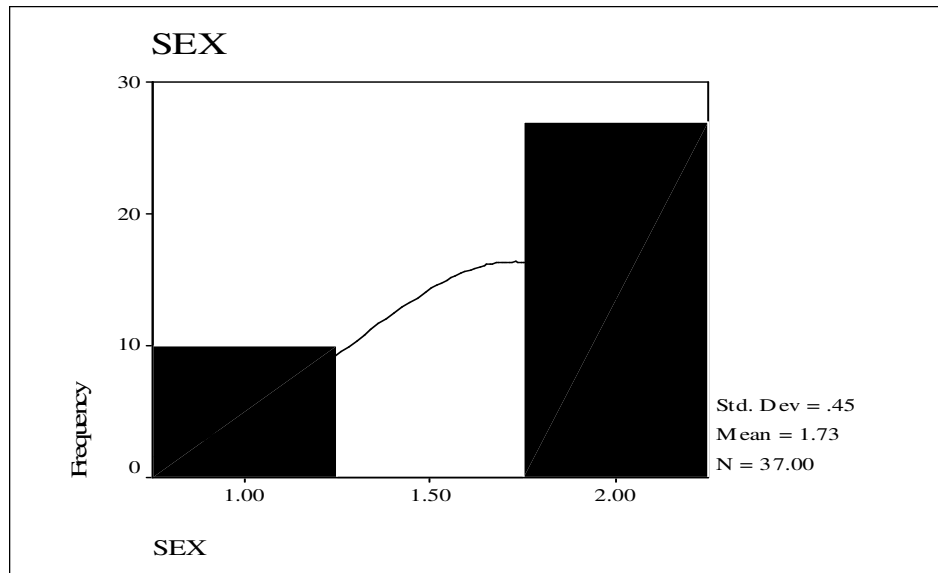
Age in Years



Legend: 1 (18 - 29), 2 (30-39), 3 (40-49), 4 (50-59), 5 (60-69) & 6 (70 or older)

Figure 3

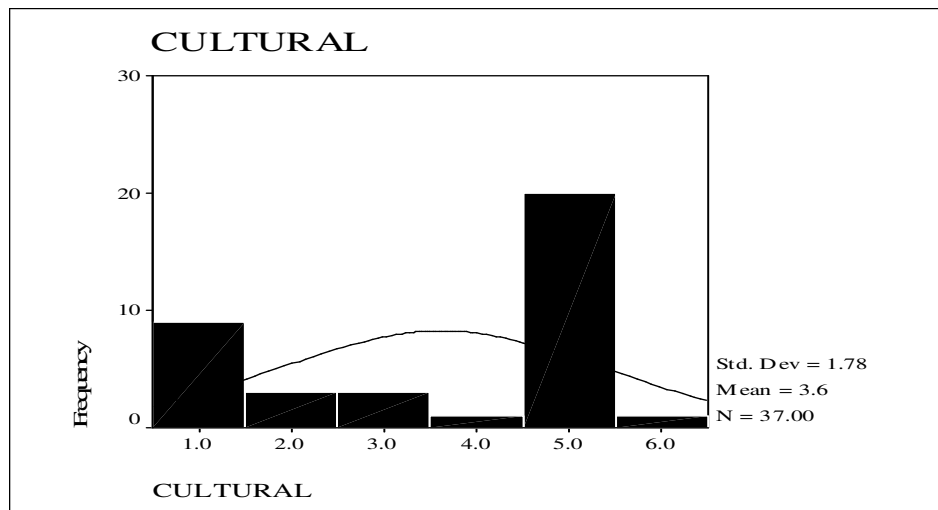
Sex



Legend: 1 (Female) & 2 (Male)

Figure 4

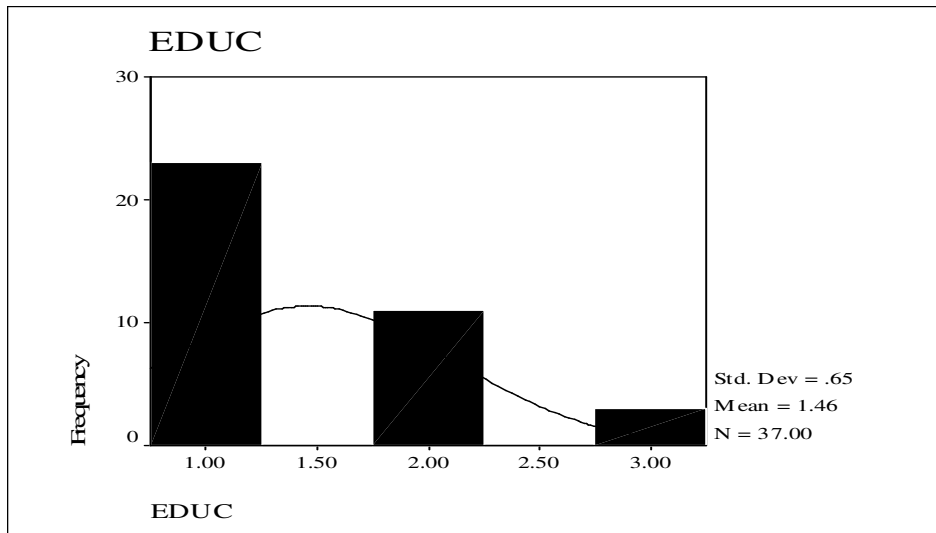
Cultural Background



Legend: 1 (Asian or Pacific Island); 2 (Black/African American); 3 (Hispanic/Latino);
4 (American Indian or Alaska Native); 5 (White/Caucasian); & 6 (Other)

Figure 5

Highest Level of Education Obtained



Legend: 1 (BA, BS or equivalent); 2 (Masters); & 3 (Doctorate)

Figure 6

In summary, the majority of the survey respondents were between the ages of 30 to 49. The male respondents outnumbered females almost 3 to 1. The primary cultural background of the respondents was Caucasian followed by Asian. Thirty-nine percent of the respondents had obtained a masters degree or higher. It should be noted that the demographics of the survey respondents do not mirror the population of the USA.

The first null hypothesis to be tested is:

Hypothesis 1. Coalescent knowledge dimension does not exist.

Statistical Test Results for the First Hypothesis

<u>Hypothesis Test</u>	<u>Q5.3 Beliefs</u>	<u>Q6.3 Values</u>	<u>Q7.2 Ideas</u>	<u>Q8.3 Knowing How</u>
Sum (Q)=	35	21	6	28
No. of Obs (n)+	37	37	37	37
Means [Y(BAR)]=	0.95	0.57	0.16	0.76
Std. Dev. (s)=	0.23	0.50	0.37	0.44
Test mean =	0	0	0	0
<u>T-Value</u>	24.76	6.78	2.60	10.44
df	36			
One-tail test for				
Alpha of .05 for df:	1.69	1.69	1.69	1.69
Mean > 0	Yes	Yes	Yes	Yes
Reject Ho if the mean is greater than 0				
Effect Size	4.12	1.13	0.43	1.74

Table 1

Thirty five (35) out of the thirty-seven (37) respondents selected Others or Documents as the knowledge source for the beliefs question. The mean (0.95) for this question was found to be significantly greater than zero (0) [α of 0.05, one-tail]. Twenty one (21) out of the thirty-seven (37) respondents selected Others or Documents as the knowledge source for the values question. The mean (0.57) for this question was found to be significantly greater than zero (0) [α of 0.05, one-tail test]. Six (6) out of thirty-seven (37) respondents selected Others or Documents as the knowledge source for the ideas question. The mean (0.16) for this question was found to be significantly greater than zero (0) [α of 0.05, one-tail test]. Twenty eight (28) out of thirty-seven (37) respondents selected Others or Documents as the knowledge source for the skills (knowing how) question. The mean (0.76) for this question was found to be significantly greater than zero (0) [α of 0.05, one-tail test]. The effect size was calculated for each of the questions by

subtracting the Test Mean from the Study Mean [Y(BAR)] and dividing the difference by the standard deviation (Howell, 1999). An example using the data from the values question is: $(0.57 - 0)/0.50 = 1.13$ effect size). Howell (1999) states that effect size is always expressed in absolute value. In the calculation of the sample size for the survey, the effect size used was 0.5 (or medium per Cohen, 1988) and the probability of correctly rejecting a False H_0 was 90 %. Therefore, any effect size of 0.5 or greater should have a high probability of correctly rejecting a False H_0 . In Table 1 the effect size for the beliefs, values, and knowing how questions have an effect size that provides a high probability of rejecting a False H_0 . The ideas question has a lower probability of rejecting a false H_0 .

First Hypothesis Test Results

<u>Questions</u>	<u>Results</u>
Question on Belief (5.3):	
$H_0: \mu_{5.3} \leq 0$; Accept the Null Hypothesis	
$H_1: \mu_{5.3} > 0$; Reject the Null Hypothesis	X
Question on Values (6.3):	
$H_0: \mu_{6.3} \leq 0$; Accept the Null Hypothesis	
$H_1: \mu_{6.3} > 0$; Reject the Null Hypothesis	X
Question on Ideas (7.2):	
$H_0: \mu_{7.2} \leq 0$; Accept the Null Hypothesis	X
$H_1: \mu_{7.2} > 0$; Reject the Null Hypothesis	
Question on Knowing How [Skills] (8.3):	
$H_0: \mu_{8.3} \leq 0$; Accept the Null Hypothesis	
$H_1: \mu_{8.3} > 0$ Reject the Null Hypothesis	X

Table 2

Statistical tests (See Table 2 above) indicate that, 3 of the 4 questions rejected the null hypothesis: *Hypothesis 1. Coalescent knowledge dimension does not exist.*

Therefore, the test indicates that **Coalescent knowledge dimension does exist.**

The second null hypothesis to be tested is:

Hypothesis 2. The primary source of a person's knowledge is NOT the coalescent knowledge dimension.

Statistical Test Results for the Second Hypothesis

<u>Hypothesis Test</u>	<u>Q5.3 Beliefs</u>	<u>Q6.3 Values</u>	<u>Q7.2 Ideas</u>	<u>Q8.3 Knowing How</u>
Sum (Q)=	35	21	6	28
No. of Obs (n)+	37	37	37	37
Means [Y(BAR)]=	0.95	0.57	0.16	0.76
Std. Dev. (s)=	0.23	0.50	0.37	0.44
Test mean =	0.5	0.5	0.5	0.5
<u>T-Value</u>	11.67	0.8072	-5.4244	3.6418
df	36			
One-tail test for				
Alpha of .05 for df:	1.69	1.69	1.69	1.69
Mean > 0.5	Yes	No	No	Yes
Reject Ho if the mean is greater than 0.5				
Effect Size	1.95	0.14	-0.90	0.59

Table 3

In Table 3, the Beliefs and Knowing How (skills) question rejected the null hypothesis. The rejection has an effect size that provides a high probability of rejecting a False H₀. Therefore, the test indicates that **the primary source for a person's knowledge is the coalescent knowledge dimension.**

A Pearson correlation test was performed on all data elements for the recoded hypothesis linked question. The results did not indicate any significant correlation to or between the hypothesis-linked questions.

Limitations of Study and Future Research

One of the limitations of the study is that the survey respondents were all graduate students attending the Stevens Institute of Technology, Howe School of Technology Management. In this case, the ability to generalize the results of the study to a larger population is limited.

The survey respondents were self-reporting via recollection. Therefore, the potential exists for single source bias in the recollection process. In most studies, single source bias is a concern when rating constructs (Avolio, Yammarino, & Bass, 1991). Avolio, Yammarino, and Bass (1991) state that “single-source bias is a special case of common method bias. They state that “all other things being equal, single source bias is operationalised as the degree to which the relationship between two variables deviates from the true score correlation when using a single source, producing what Chapman and Chapman (1969) have labeled the illusory correlation.” They further state that “single source effects are not necessarily an either or issue, but are perhaps a function of a number of factors and may be a matter of degree.” In this study, there were no significant correlations to report and there cannot be a reliable alternative for a respondent’s source of knowledge.

Some of the limitations provide areas for future research. In this study, the population sample is graduate students. The population used in future research should be a population that is more diverse. In addition, only one belief, value, and skill (knowing how) were tested. Future research could look at a range of beliefs, values, skills (knowing how) to see if there is a distribution among documents, self, and others as sources of knowledge. It may be possible that some beliefs, values, and skills are highly personal and self is the primary source of this

knowledge. Some other sources of knowledge may be accepted as personal knowledge, when the knowledge is not considered highly personal (defining the individual).

Conclusion

The research into the coalescent knowledge dimension demonstrated that it exists in the real world. The coalescent knowledge dimension was empirically tested. This test used a selected sample of graduate students in the Stevens Institute of Technology's Howe School of Technology Management, who were in a Masters in Technology Management program. The data collection method was a survey. The first null hypothesis is:

Hypothesis 1. Coalescent knowledge dimension does not exist

Because the study is a proof of theory, the decision logic of the statistical test was structured so that if the means of all four hypothesis-linked questions was NOT $>$ zero (0), then the null hypothesis would be accepted. The survey results showed that three (3) out of the four (4) questions rejected the above null hypothesis. Therefore, the null hypothesis was rejected. The one-tail tests were conducted using an alpha of 0.05. The statistical test results showed that three of the questions rejecting the null hypothesis had an effect size greater than 1.0.

Because the study is a proof of theory, the second null hypothesis investigated whether or not the coalescent knowledge dimension was the primary source of a person's knowledge. The null hypothesis is:

Hypothesis 2. The primary source of a person's knowledge is NOT the coalescent knowledge dimension

The decision logic of the statistical test was structured so that if the means of all four hypothesis-linked questions were NOT $>$ 0.5, then the null hypothesis would be accepted. The survey

results showed that two (2) out of the four (4) questions rejected the above null hypothesis. Therefore, the null hypothesis was rejected. The one-tail tests were conducted using an alpha of 0.05. The statistical test results showed that the question rejecting the hypothesis had an effect size greater than 0.5.

The results of the research reported in this paper verified empirically that the coalescent knowledge dimension is more than just a theory. It exists in the real world for the population surveyed. Based on the research reported in this paper, variables for future research into coalescent knowledge can now be defined and operationalised. The major contribution of this research is that the door has been opened for additional research and the development of management practice for managing coalescent knowledge in the organization.

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