ISSUES IN MEASURING SITUATED COGNITION: CASES OF SITUATIONAL JUDGMENT TESTS

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Abstract

In spite of the importance of situated cognition, it is not easy to figure out its structure. The major reason for this is the argument that cognition cannot be discernable from the situation where it operates. However, the traditional model(dimension-based model) is still needed for understanding the cognitive mechanism and for providing developmental diagnosis. We employed three-step approach for separating cognition and situation on a set of situational judgment data we collected from the domain of insurance sales. As a result of three-step approach we obtained three dimensions of practical knowledge: flexible thinking, pursuit of shor-term goals, and understanding the core problems. However, it should be emphasized, those dimensions are knowledge structure that are interpretable and useful in the situations that are critical for insurance sales domain. Also we developed a method of computing proportion of variance attributable to situations when the problem situation is perceived as multiple dimensions instead of unidimension and when the situations are correlated.

Keywords: situated cognition, situational judgment test, method variance, three-step approach, socio-cultural perspective.

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Suggested track: B(Epistemology of knowledge)

1. Introduction

Whereas traditional concept of cognition is context free, cognition from socio-cultural perspective is context-laden and situation-bounded. The cognitive revolution started from 1950's has been instrumental for formulating theories of cognitive processes for the next two to three decades. Now, we live in an era of socio-cultural revolution which compels us to recognize the style of activities and their interactions defined in the society or culture in order to understand cognitive development of individuals(Wertsch, Minick, & Arns, 1984). Context-laden assessment is at issue at any level of human activities and systems. Suthaland(1996) argues "that at all levels, assessment is a social activity and we can understand it only by taking account of the social, cultural, economic, and political contexts in which it operates"(recited from Gipps, 1999: 355). We need to understand cognition situated at activity systems such as socio-cultural, economics, or political systems in organizations.

Since socio-cultural perspective has been introduced as a new philosophy of assessment, we do not consider knowledge as something objective and independent of the knower. Now the term "culture-free" gets a body of critism. In the postmodern era, many activities are seen as value laden and socially constructed. Knowledge creation and assessment are not exception. Measurement of knowledge and cognition is not in pursuing objective, context-free construct, but in tapping constructs that are relevant, fair, and adequate for a given situation(Gipps, 1999). Then there is no calling for such thing as all-purpose context-free knowledge. To be context-relevant, relevant situation should be used. Since performance is situated, good situations wherein respondents act are needed. The situation or task should be able to elicit elaborated performance assessors want to observe from the performer. This perspective introduces a lot of implications for assessment of knowledge.

Recent developments of situational judgment tests(SJTs) as low-fidelity simulations (e.g., Motowidlo, Dunnette, & Carter, 1990; Pulakos, Schmitt, & Chan, 1996) have contributed to their popularity in industrial and organizational settings as tools for measuring situated cognition such as judgment competencies encountered with problem situations. A situational judgment test is comprised of scenarios or passages and a number of response alternatives or multiple choice questions following them. SJTs have several advantages such as (a) good criterion validity(ρ=.34 in McDaniel et. al, 2001) for the relatively low expense of development and the convenience of management (Motowidlo, et. al., 1990; Motowidlo & Tippins, 1993), (b) high face validity (Motowidlo, et. al., 1990) due to the items reflecting practical situations and behaviors.

2. Two Issues in Measurement of Situated Cognition

There are two important issues related to measurement of situated cognition such as job knowledge, tacit knowledge, or knowledge structure in organizations. At first, measurement of situated cognition accompanies situational characteristics in addition to cognition. Second, since situated cognition is accrued when a person participates in the surrounding situations/environment in an active manner, environment is not discernible from cognitive process. In this study, we attempt to delineate these complicated issues in situational judgment data. From the conventional viewpoint of information processing, situational characteristics reflected in the measurement are error or method bias that are to be separated from the measured data.

However, from a new perspective of socio-cultural revolution, we can understand organizational knowledge only by taking account of the social, cultural, economic, and sometimes political contexts in which it operates. Especially we are interested in Situational judgment tests(SJTs) that are used in organizational settings and measure individual's practical knowledge acquired by participating in her working environment.

In this study of analyzing situational judgment data, our position is in between cognitive perspective and socio-cultural perspective. Lievens and Conway's(2001) delineation of three different models in assessment center studies is useful for our purpose. A dimension-based model has focused on the construct measured like SJTs were originally conceived as a way to assess stable individual competencies such as problem-solving, strategic skills, communication, or ability to plan, prioritize, and organize. Construct-driven approach would extend the utility of measuring situated cognition to many areas in organizations. With the knowledge of construct structure in situational judgment data, we can provide appropriate feedback to those who are concerned with human resource planning and development. In order to diagnose managerial strengths and weaknesses, we need to know construct dimensions emerging from situational judgment data. Without knowing what exact constructs are measured, we may take a risk of using invalid measures for management purposes.

Despite the need of focusing on constructs, there has been no consensus about what is being measured by SJTs. It is surprising that we have never verified the dimension-based model in the measurement of situated cognition. We have not used those dimensions for communication or management purposes. Rather the total scores were used for criterion validation. This is a model analogous to exercise-based model in AC studies. The total scores reflect the cross-situational consistency of the performer or knower in a given domain, not scores on cognitive dimensions.

Investigators have attempted to show the degree that the total scores are related with other constructs. In McDaniel, et. al's(2001) meta analysis, situational judgment scores are related with cognitive ability(ρ=.46). This is an indirect way of investigating the construct structure of SJTs. With this indirect approach other researchers argued that constructs of situational judgement later may be practical intelligence/tacit knowledge (Wagner &

Sternberg, 1993), job knowledge (Schmidt, 1994), multidimensional attributes (Chan & Schmitt, 1997), or perhaps knowledge for success in life or academic settings (Oswald, Schmitt, Ramsay, Kim, & Gillespie, 2003). However, we have no consensus yet. Drawing from this reality, some researchers contend that situational judgment data could just represent measurement methods, rather than specific constructs (McDaniel, et. al., 2001; Weekley & Jones, 1999). Since the total scores are situation-based, not dimension-based, we will call this situation-based model in measuring situated cognition. In the dimension-based model, situation effect may be regarded as sources of construct-irrelevant variance. In the situation-based model situation effect or total scores of SJT are just fine for predicting behavior of organizational members.

However, measurement of situational judgment can be viewed from a combination of correlated knowledge dimensions and situational scenarios as methods. This view is analogous to the combination model in AC studies(Lievens & Conway, 2001). Situation effect may also be regarded as sources of construct-relevant variance(see Lance, et. al., 2000; Lievens & Conway, 2001). Lance, et. al.(2000) demonstrated that some exercise factors in AC studies are interpretable as cross-situational consistency/specificity in determining AC performance instead of unwanted method bias.

Drawing from Kudisch, Ladd, and Dobbins(1997), Lievens and Conway(2001) emphasized that we need to include the situation factors in providing dimension feedback. That is, knowledge dimensions should not be the only focus, but the environment or situation where the knowledge operates should also be concentrated. These context-specific application would not concentrate on all-purpose knowledge or skills. Suppose we talk about leadership skills. From the viewpoint of combination model, there is no such thing as all-purpose leadership skills. Rather it should be clear whether the leadership of interest is pertinent to group situations or dyadic situations. As socio-cultural perspective does not deny the importance of cognitive perspective, we do not devalue the dimension-based approach, rather we want to add perspective of situational specificity in which a certain knowledge/skill operates. Thus, it is still necessary to separate the construct(s) and situation effect for guiding development of measurement tools that are not overly affected by the situation and building theories across situations. In the present study we will SJTs as the measurement tool of situated cognition, but we will attempt to employ the perspective of combination model.

3. Situational Judgment Test as a Tool of Measuring Situated Cognition

3.1 SJT and Measurement of Situated Cognition

SJTs have long history of being used for measuring situated cognition; they have been used from 1920's(McDaniel, et. al., 2001). Although SJT has been originated from the conception of measuring dimensions, it has been viewed as a measurement method(e.g., McDaniel, et. al., 2001; Weekly & Jones, 1999) because it has been difficult to delineate the dimensions and situations. The situations represented by scenarios in SJTs are viewed as method from psychometric sense, meaning that situation effect, scenario effect, or method effect are all interchangeable.

For our empirical approach to estimating cognitive dimensions, and delineating construct variance and method variance, we developed a SJT in a domain of insurance sales. Current state of empirical research for separating dimensions and method has not been much successful. Although they set out with many hypothetical/preliminary dimensions the researchers did not attempt to directly verify the dimensions per se. In the present study, we employ a direct approach to estimating trait factor structure in situational judgment test data, which could be a one step advance in the separation of cognitive mechanism and situation effect. We adopt Lee and Kim's(2002) three-step approach for delineation of cognitive dimension and practical situations where the knowledge operates. The rationale starts from the common factor model including dimensions and method factors. An SJT contains multiple situational scenarios each of which has fixed effect on the response alternatives or multiple choice questions under it.

If the items under each scenario measure relatively independent dimensions, the cause of correlations among items in a scenario can be attributed to the scenario effect. In a scenario, correlations among item scores can be attributed to the shared frame of interpreting the situation described in a scenario. Then a three-step approach proposed by Lee and Kim(2002) can be useful for estimating trait dimensions. At the first step, an exploratory factor analysis can be performed for the data of a scenario and an item score is residualized by subtracting scenario effect scores from it. When all the items are residualized across scenarios, another exploratory factor analysis can be conducted on all the residualized scores(step 2). The resultant structure would represent a common factor structure of cognitive dimensions or trait factors. Finally, going back to original data, a confirmatory factor analysis is conducted with specification of trait structure and scenario effect. In the frame of confirmatory factor analysis, trait structures are specified as given in the step 2 and scenario effects are specified following the correlated uniqueness model of Kenny and Kashy(1992)(step 3).

In this three-step analysis, step 1 is the critical step of providing the possibility that we can formulate SJT data as MTMM data. Since cognitive structure is not expressed as a factor model in SJT data, we need to conduct an exploratory factor analysis to explore potential trait structure in SJT data. Once the potential trait structure is obtained, scenario effects are viewed as method factors. Then SJT data are formulated as multitrait-multimethod(MTMM) data. This type of MTMM data can be analyzed in the frame of structural equation modeling—especially confirmatory factor analysis.

3.2 Formulating SJT Data as MTMM Data

Analysis of MTMM data is one of the classical methods of verifying construct dimensions since Campbell and Fiske's(1959) proposition. If we can formulate SJT data as MTMM data, combination model perspective of SJTs would be readily realized. Rationale that allows SJT data to be formulated in the frame of MTMM data will be described. There have been two major ways in developing and scoring the SJTs. Most SJTs have relatively short scenarios and small number(e.g. 4~6) of response alternatives among which respondents are asked to choose best and/or worst alternatives. Sternberg and his colleagues(Sternberg, et. al., 2000; Wagner & Sternberg, 1993) developed relatively long scenarios and large number of response alternatives(5~20) on which respondents are asked to rate their effectiveness given the situational scenario. Whereas most researchers of SJT used to score scenario-wise using each scenario as an item(see Chan & Schmitt, 1997 for exception, they scored each response alternative), Sternberg and his colleagues scored each response alternative as an item. However, most of the researchers used the total test score instead of attempting to divide it to two parts: trait score, situational effect.

We cannot estimate cognitive mechanism from the item data using scenarios as items because there is no way of separating scenario effect and trait scores in the item scores. We will call this type of items 'fusion items'. Scenario effect refers to the effect that a scenario has across response alternatives or questions of multiple choice consistently as a context embedded in response processes. Since it is not related to the dimensions to be measured, it is a kind of method effect. When we treat response alternatives as items, it is more likely that we can separate scenario effect and trait scores since scenario effect occurs repeatedly over multiple items. We will call the type of items that allow separation of scenario effect from the item scores 'divisible items' from now on. Sternberg and his colleagues, and Chan and Schmitt(1998) used divisible items. When traits are measured by multiple methods(i.e., scenarios) and methods are used to measure multiple traits(i.e., in the items), SJT data can be viewed as an MTMM(multitrait-multimethod) matrix and the rationale of Campbell and Fiske(1959) can be applied for analysis. Analysis of MTMM matrix can be performed by a strong statistical method such as confirmatory factor analysis, by which cognitive structure, situational effect, and measurement errors are distinguished(cf., Widaman, 1985).

3.3 Three Steps in Analysis of Situational Judgment Data

Although we can define method factors from situational scenarios, we do not have well-defined trait structure in SJT data. They develop scenarios from work situations or critical incidents that allow to measure or observe sample behaviors for the certain constructs. Since scenarios are like low fidelity work sample, steps 1 and 2 of three-step approach are very important in deriving potential trait structure. Step 1 starts with factor-analyzed data of a scenario. The factors in this within-scenario analysis are considered as method factors and scores attributable to the factors are subtracted from item scores, yielding residualized scores. In step 2, exploratory factor analysis is conducted on the residualized data integrated across scenarios.

At the end of step 2, we recommend to suspend the interpretation of factors until we finish a confirmatory factor analysis where the factor structures would be refined through specification search. For that reason the results of exploratory factor analysis in step 2 are a temporary factor structure based on which potential trait structures are prepared for the next step—confirmatory factor analysis. The procedure of step 3, confirmatory factor analysis on SJT data would be analogous to the analysis of MTMM data in a confirmatory factor analysis(Joreskog, Sorbom, du Toit & du Toit, 2000).

To begin with, we assume just one method factor for a scenario; this method factor will be called the macro-method factor. We do not exclude the possibility that there are multiple method factors for a given scenario; these method factors will be called micro-method factors. As specification search is performed, we hope the method effect confounded in the potential trait structure find its place in the portion of method factors. However, there are many models in specifying MTMM data in the frame of confirmatory factor analysis, which will be discussed next.

Since models of confirmatory factor analysis for analyzing MTMM data were well specified by Widaman (1985), many applications have been made. However, specification of the two different types of factors – trait factors and method factors – in a typical form of CTCM (correlated trait correlated method) model often resulted in severe difficulties such as non-convergence and improper solutions (Kenny & Kashy, 1992; Marsh, 1989). Campbell and Fiske(1959) urged the use of independent methods because assessment of method variance depended on the assumption of independent methods in the MTMM analysis of observed variables. However, even the CTUM (correlated trait uncorrelated method) model does not resolve problems in computation (Kenny & Kashy, 1992; Marsh, Byrne, & Craven, 1992). In order to avoid these difficulties, CU model(Kenny, 1979; Kenny and Kashy, 1992; Marsh, 1989) is recommended where unique factors are correlated with each other instead of method factor models such as UM or CM. With CU model the degree of covariation between the unique factors measure the method factors. As we assume one method factor for a scenario, the macro-method factor will be represented by correlated uniquenesses among all the pairs of items in a scenario. The possibility of micro-method factors for a scenario will be determined by the patterns of uniqueness correlations for each scenario. The potential correlations between scenarios can be tested by selectively freeing the uniqueness correlations between items associated with different scenarios.

Development of a set of SJT and operationalization of three-step approach will be described in the method section. Subsequent analyses and results will be given in the results section. Finally, our findings will be summarized and some issues will be discussed.

4. Method

We developed sixteen short scenarios all together and maximum six response alternatives for each scenario. Two scenarios were discarded because they were judged to be inappropriate. The response alternatives were written to be relatively independent under a scenario. We used seven point scale to rate the effectiveness of each response alternative: 1=worst … 7=best. We collected responses from 498 insurance sales people. In obtaining individual's score on items, we used the mean profile of ratings by 27 experts who are recognized as model performers in the insurance company. These experts are not included in the pool of data for analysis. The absolute value of the difference between each respondent's score and mean score of experts is subtracted from 7 and the value is used as the score given to the respondent on the item.

In order to estimate combination model of cognitive mechanism and situational effect, we employed Lee and Kim's(2002) three-step approach.

Step 1: Standardize and Residualize

At first, all the scores are standardized and analysis is performed for the data of each scenario. Then the portion of scores contributed by the common factor(s) is subtracted from the standardized item score. This is the residualized item score. Once the residualized scores are collected across all the scenarios, we are ready to perform step 2, exploratory factor analysis on the residualized data matrix.

Step 2: Exploratory Factor Analysis on Residualized Data

We used PROC FACTOR in the Statistical Analysis System version 8. We employed common factor model with principal axis factoring to obtain the initial solution(SMC for prior communality estimate). A orthogonal rotation(VARIMAX) was performed to get the final solution. After scrutinizing the final solution, a potential trait structure will be prepared to be input at step 3.

Step 3: Confirmatory Factor Analysis on the Original Data

Confirmatory factor analysis will be conducted on the original item scores with specification of trait factors following the potential trait structure obtained in step 2. Method effects will be represented by correlated uniquenesses in each scenario.

5. Results

Results from step 2 will be presented. At first, the eigenvalues from principal axis factoring are given in Table 1.

Table 1. Eigenvalues of Residualized Data

Number	1	2	3	4	5	6	7	8	9	10
Eigenvalues	4.01	1.83	1.11	0.91	0.86	0.71	0.57	0.47	0.35	0.34
Differences	2.18	0.71	0.19	0.05	0.14	0.13	0.10	0.11	0.006	0.06
proportion of variance	0.41	0.19	0.11	0.09	0.08	0.07	0.06	0.04	0.03	0.03
Accumulated proportion of variance	0.41	0.61	0.72	0.82	0.91	0.99	1.04	1.09	1.13	1.17

Examining scree test and accumulated proportion of variance, the number of factors are judged to be between 3 and 6. We ran different solutions for 3, 4, 5, 6 factors to evaluate the interpretability. The three-factor solution seemed to be consistent in four-factor solution where the fourth factor was not interpretable. In the five or six factors solution, the factors in three-factor solution were split and no additional factors were interpretable. We chose three-factor solution as shown in Table 2. In table 2, final solution is given with factor loadings and communalities for the items. Three scenarios and the associated items were not interpretable and they are shown in Table 2. Loadings over .3 are shaded and they will be imposed as free parameters in step 3.

Table 2. Factor Loadings and Communalities

Scenario No.	Item number	Factor 1	Factor 2	Factor 3	Communality
1	S11	-.44	.00	-.11	.20
5	S58	.45	-.02	.04	.20
	S59	.15	-.13	.39	.19
6	S61	.38	-.38	.00	.29
	S66	.11	-.15	.33	.14
7	S74	.15	-.18	.40	.22
	S75	.06	.44	.01	.20
	S76	-.15	.65	-.14	.47
8	S81	.51	-.14	.17	.30
	S85	.26	-.11	.30	.17
	S86	.04	.14	.33	.13
	S89	-.11	.71	.00	.52
9	S92	.07	.16	.35	.15
	S93	.34	.14	.09	.14
	S96	.43	-.21	.01	.23
10	S102	.30	-.13	.35	.23
	S103	.36	.35	-.09	.26
12	S123	.34	-.14	.25	.20
	S126	.43	-.03	.18	.22
14	S143	.07	-.03	.39	.16
	S146	.46	-.03	.07	.22
15	S151	.49	-.05	.10	.25
	S152	.31	.15	-.02	.12
	S154	-.35	.35	.26	.32
	S158	.38	-.19	.12	.20
16	S164	.48	-.06	.18	.27
	S165	-.10	.50	.03	.26

Items in each scenario are well spread over the three factors except items in scenario 15, demonstrating less likelihood that factors are overly affected by method effects. Although the factor structure indicated by shaded loadings represents ‘the potetial trait structure’, we do not exclude the likelihood that this structure is confounded with potential method effect. Factors indicated by many items from an identical scenario can be suspected of potential method effect confounded in the solution: From scenario 15, four items loaded on factor 1. This confounded fashion of structure will be refined in step 3.

Step 2: Confirmatory Factor Analysis

We went back to original data and conducted a confirmatory factor analysis with the factor structure from step 2 and the specification of method effects representing scenarios as hypotheses. To the potential trait structure given in table 2, we will add specification of method effects based on the design of the test. We know that the test is divided into several scenarios. Each scenario effect could be elaborated into micro-method factors. However, delineating the nature of the method effect is not of interest in the present study. So, we will specify the macro-method factors according to the distinction of the scenarios in the test. The macro-method factors will be represented by all pairs of correlated uniquenesses in each scenario. We hope that the three potential trait structure from step 2 and the method effects will be refined through the specification search provided in the method of confirmatory factor analysis.

We analyzed the original covariance data as in the step 1 with ML as the estimation method. Correlations between the three factors from step 2 are specified free. For software we used Lisrel 8.52 (Joreskog, Sorbom, du Toit, & du Toit, 2000). The process of the specification search is given in table 3.

Table 3. Specification Search Process

Model	Specification	Fit Measures	Important Information
Model 1	1) 3 factors correlated 2) free parameters for shaded loadings in Table 3 3) all correlated uniqueness within each testlet 4) factor variances are fixed at 1.0 to provide scales 5) estimation method: ML	DF=293 χ^2=1093.22(p=.00) RMSEA=.077 ECVI=2.67 NFI=.75 NNFI=.77 CFI=.80 GFI=.85 AGFI=.81	-poor fit -need to free factor loadings with large values of modification index(MI) -largest MI after each modification F2→S151, MI=60.76 F3→S152, MI=36.33 F3→S93, MI=31.93 F2→S146, MI=42.06 F2→S126, MI=23.28
Model 2	1) same as Model 1 2) five factor loadings are freed	DF=288 χ^2=874.25(p=.00)	-overall fit needs to be improved. -M1 vs M2:

	one by one 3)~5) same as Model 1	RMSEA=.065 ECVI=2.18 NFI=.80 NNFI=.83 CFI=.86 GFI=.88 AGFI=.85	$\Delta\chi^2$=218.97, Δdf=5, p<.001 Significant Improvement of fit in Model 2 -can improve fit by freeing ten uniqueness correlations
Model 3	1) same as Model 1 2) same as Model 2 3) ten uniqueness correlations are fixed 4)~5) same as Model 1	DF=295 χ^2=627.84(p=.00) RMSEA=.052 ECVI=2.74 NFI=.86 NNFI=.89 CFI=.91 GFI=.91 AGFI=.88	-overall fil is fair -M2 vs M3: $\Delta\chi^2$=246.41, Δdf=10, p<.001 Significant increase of fit -small t-values on some free parameters
Model 4	1) same as Model 1 2) six factor loadings are fixed 3) fifteen uniqueness correlations are fixed 4)~5) same as Model 1	DF=296 χ^2=645.63(p=.00) RMSEA=.05 ECVI=1.68 NFI=.85 NNFI=.90 CFI=.91 GFI=.91 AGFI=.88	-overall fit is fair -M3 vs M4: $\Delta\chi^2$=17.69, Δdf=21, p>.10 -Insignificant decrease of fit -more parsimony -termination of specification search

Note:

- χ^2: normal theory weight least squares chi-square.
- RMSEA: Root mean square error of approximation
- ECVI: Expected cross-validation index of a focal model.
- NFI: Normed fit index
- NNIF: Non-normed fit index
- CFI: Comparative fit index
- GFI: Goodness of fit index
- AGFI: Adjusted goodness of fit index

Model 1 is the initial model, with twenty seven measured variables, three factors, and all uniquenesses correlated within each scenario. The overall fit measures indicate that the

Model 1 represents poor fit. The overall fit measures for Model 2 are significantly better than Model 1, but not satisfactory yet. The χ^2 difference test between Models 1 and 2 shows that there is a significant improvement of fit in choosing Model 2. There are many uniqueness correlations which values of MI are large. In Model 3, we freed ten uniqueness correlations between items associated with different scenarios. Overall fit was fair in Model 3. However, there were many insignificant parameter estimates. So, there is a need to improve parsimony by fixing some parameters with small t-values(|t|<2.0).

Model 4 shows fair fitting, and a χ^2 difference test showed that with Model 4, the fit did not decrease significantly. So we can choose Model 4, a model of more parsimony. Table 4 show the results. In Table 5, all loadings are of interpretable size.

Table 4. Standardized Factor Loadings(t-values) of Model 4

Testlet No.	Item No.	Factor 1	Factor 2	Factor 3	SMC1	Method Variance	SMC2
1	S11	.17(3.13)			.03	.35	.38
5	S58	.33(6.50)			.11	.25	.36
	S59	.33(4.49)			.07	.25	.32
6	S61		.51(11.37)		.25	.21	.46
	S66			.35(7.15)	.13	.15	.28
7	S74		.27(5.03)		.13	0	.13
	S75		.66(13.35)		.38	0	.38
	S76		.73(17.50)		.53	0	.53
8	S81	.37(7.55)			.14	.27	.41
	S85			.27(5.30)	.07	.15	.22
	S86			.46(9.04)	.21	.05	.26
	S89		.79(19.83)		.63	.01	.64
9	S92			.65(13.46)	.42	.09	.51
	S93	.67(7.98)			.24	.05	.29
	S96	.28(5.20)			.08	.09	.17
10	S102	.37(7.10)			.13	.12	.25
	S103		.50(11.31)		.25	.17	.42
12	S123	.28(5.39)			.08	.16	.24
	S126		.22(4.65)		.05	.13	.18

14	S143			.48(9.47)	.23	.04	.27
	S146	.10(1.92)	.32(6.36)		.13	.17	.30
15	S151	.42(7.77)	-.40(-7.59)		.23	0	.23
	S152	.75(8.07)			.33	.04	.37
	S154	.44(8.50)	-.52(-9.96)		.33	0	.33
	S158	.22(4.20)			.05	.09	.14
16	S164	.44(8.89)			.20	.20	.40
	S165		.62(14.24)		.39	0	.39
Mean					.22	.11	.33
SD					.15	.10	.13

The items are given in Table 5. We attempt to interpret the three dimensions in reference to descriptions in Table 5.

Table 5. Descriptions of Items

Item No.	Situations(Scenarios)	Items
S11	Children ask more allowances than planned	Give away for this month but ask him/her to show the record of use.
S58	Conversation with a nurse	Begin talking about weather, sports, and concurrent news.
S59		Ask about her motivation to become a nurse.
S61	Forced to live in rural area, although you have lived an active life	Come back to the urban area that I used to live.
S66		As the interest about the area increases, I will study about the agricultural drugs and fertilizer.
S74	Encountered with a person speaking a dialect you cannot understand	While telling her that her speaking dialect makes him feel at home, try to convert the atmosphere.
S75		Find a staff who is good at the dialect and turn the customer over to the staff.
S76		Tell her that you are busy and urge her to communicate in emails
S81	Encountered with a stubborn customer	Remind her that I am an expert and have more information than herself
S85		Confirm whether the customer understands by asking questions and checking answers.
S86		Understand the key points in customer's arguments and give him short and accurate responses to the points.
S89		Introduce other staff to her.
S92	Teaching son who does not want to learn cooking traditional	Tell him a story about the food and remind him that work on food is reflection of his mind.

S93	food	Tell him to learn cooking again. If he does not listen, tell him to do whatever he would like to.
S96		Appraise other person who is good at cooking the food and steer my son toward what that person does.
S102	Two seasonal businesses such as ice cream production and ski-resort operation	Merge the staffs to open a new business that is not affected by seasonal change.
S103		Sell the two businesses and buy a new business
S123	How to avoid a subtle tactic of a landlord	Quit the lease and rent a different store
S126		Sue the landlord and fight through illegitimate behavior
S143	Situation where you are transferred to a new department	Figure out names of staffs and characteristics of the department
S146		Start with a least risky work
S151	Continuous complaints from customers	To begin with, tell them we are sorry.
S152		Agree with the complaints and talk about what they complain.
S154		Understand the complaints and try to soothe the emotion.
S158		To begin with, report the complaints to the boss.
S164	Figuring out the truth in the argument of customers who is not going pay for the food she had	Leave it to her conscience and ask for publicity
S165		Check her purse to see if she has money or not.

At the end of specification search, we arrived at three common factors representing the following cognitive dimensions: flexible thinking, pursuit of short-term goals, and understanding the core problems. It is important to note that these knowledge/skills and behavioral tendency are context-laden constructs. That is, they are interpretable with the work environment of insurance sales in mind.

6. Trait Variance and Method Variance in Each Item

Kenny(1995) noted that three types of methods are typical in measurement: (a) raters as method (multiple raters), (b) instrument-based methods(multiple items, tests), (c) temporal methods(multiple occasions). Out of these three methods, rater-based methods are most likely to be independent of each other because different raters would be influenced differently by method variables. Instrument-based methods are least likely to be independent because different items or instruments are likely to be influenced by the same method variables(Conway, 1996, 1998). In our case, scenarios are type of instrument-based methods and we examined the potential correlation between scenarios. It turned out to be that they are correlated with each other as we observed in Model 4.

One might suggest estimation of method effect in each item. Conway(1998) proposed a method of computing average method variance for a given measurement method and it is generalized by Scullen(1999). Conway's method is applicable to a case when unidimensionality holds for a given method and where methods are uncorrelated. So is Scullen's(1999) method of computing proportion of method variance in specific measures. The strong existence of multidimensionality for a given measurement method and the correlations between method effects in our data prevented us from applying Conway's or Scullen's method. Now we will develop our own method to compute method variance.

The variance proportion attributable to an item is obtained from the squared multiple correlation(SMC) of the item. At first, this SMC is R^2 obtained when an item is regressed on trait factors as predictors. These are shown in the column of SMC1 in Table 4.

When uniquenesses are correlated in a scenario, they represent method factors that can be expressed in the form of CTUM(correlated traits uncorrelated methods) model. For example we can draw the portion of UM when there are four items that are correlated as follows: (1, 4), (2, 4), (3, 4). A block of uniqueness correlations refers to a group of items which uniqueness are not associated with any other uniquenesses of items in a different group. Then this block can be specified as a submodel of uncorrelated method factors(see Fig. 1) in the whole model of confirmatory factor analysis.

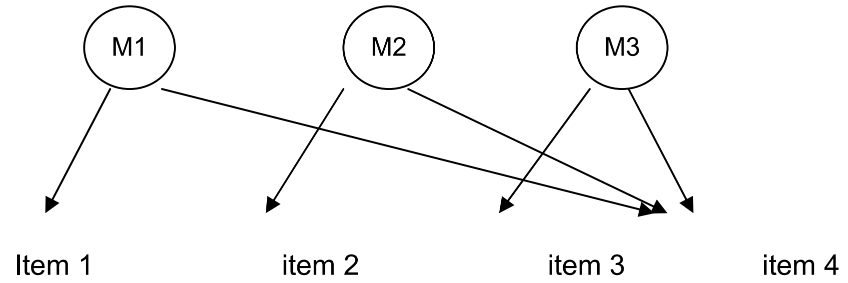

Fig. 1 Specification of UM from a Block of Uniqueness Correlations

Since Fig. 1 is an alternative parameterization of uniqueness correlations and it covers only a part of the whole blocks in a model, it is less likely to have estimation problems. We will call this model a CU-UM model since a part of CU model is reparametized as UM model. The SMC of each item when the block of uniqueness correlations are transformed into UM model block by block is given as SMC2 in Table 4. The difference between SMC2 and SMC1 is the proportion of variance attributable to method effect.

Furthermore, the method factors in Fig. 1 are uncorrelated predictors of items. Then the predictors for an item can be put into the equation one by one when transformation of a block into a CU-UM model creates estimation problems and we can compute the SMC2 of an item in Table 4 by adding up the SMCs contributed by independent method factors. For example, let's transform each uniqueness correlation in Fig. 1 into a CU-UM model one by one. To estimate M1, we can transform the uniqueness correlations (1, 4) only. Then the method variance in item 1 can be obtained by subtracting SMC1 from SMC2. However, we record the increment of SMC for item 4 due to M1. The increments of SMC for item 4 due to M1, M2, and M3 will be added up to obtain the proportion of method variance in items 4 later. This increment is always computed in reference to SMC1.

Now we return to original CU model and transform the uniqueness correlation (2, 4) only into a UM model to estimate M2. As a result we obtain the SMC2 of item 2 and the increment of SMC for item 4. We return to CU model again and transform the uniqueness correlation (3, 4) only into a UM model. As a result we obtain the SMC2 of item 3 and the increment of SMC for item 4. Since M1, M2, and M3 are mutually independent predictors of item 4 and independent from the trait factors, the addition of three incremental SMCs can be added up to get the proportion of variance contributed to by M1, M2, and M3 in the variance of item 4. When this method effect is added to SMC1, then SMC2 of item 4 is obtained.

7. Summary and Discussion

In the specification of method effect, we employed the CU(uniqueness correlations) model(eg: Kenny & Kashy, 1992) first. After obtaining a parsimonious CU model, we transformed the uniqueness correlations to CTUM(Correlated Trait Uncorrelated Method) model part by part to estimate method variance. This model is called CU-UM model here. Since method factor can be explicitly specified in the CU-UM model, we could obtain method variance as well as construct variance. If we combine the construct variance and method variance, we obtain reliability of each item when item scores are standardized. The results are given in Table 6. Overall, construct variance was higher than method variance. Although it is expected that method variance or situational characteristics play a significant role in measuring situated cognition, we can confirm that construct structure can be obtained. This supports the combination model emphasizing both cognitive dimensions and situational specificity where the dimensions operate.

Table 6. Construct Variance and Method Variance

	Mean	SD	Range
Construct Variance	.22	.15	.03~.63
Method Variance	.11	.10	.00~.35
Item Reliability[a]	.33	.13	.13~.64

[a] construct variance + method variance

We were able to tap the knowledge/skill structure embedded in the SJT data. However these dimensions should be interpreted in the context of insurance sales people, not in the context-free fashion. We can use the dimensional structure in providing feedback for training knowledgeable staffs in an organization and/or developing correct tools for selecting people who are equipped with cognitive skills that are needed in the context of a particular organization. This context-laden interpretation is analogous to the combination model in studying assessment center studies(e.g., Lievens & Conway, 2001).

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