Formative Measurement Scale Development: An Example Using Generalized Structured Component Analysis

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Abstract: Unlike reflective measurement scales, the steps for development of formative measurement scales tend to be highly subjective and involve mostly the judgment of the researcher. Formative scales have been criticized for this reason. This paper extends Christophersen and Konradt's (2008) method of joint development of a formative and reflective scale to assess mutual validity of each scale. We utilize a second order method to reduce measurement error in the formative scale as suggested by Edwards (2011), and test the efficacy of Generalized Structured Component Analysis (GeSCA) for this purpose. For illustrative purposes, we utilize a sample of formative and reflective job satisfaction survey data both to test our joint formative/reflective scale development technique and to assess which formative aspects of job satisfaction align with commonly used reflective job satisfaction scales.

Keywords: Formative measurement scales, job satisfaction, Generalized Structured Component Analysis

1. Introduction

There has been a great deal of controversy in recent literature regarding the development and utilization of formative measurement indices, culminating in special issues of *Psychological Methods* in 2007, the *Journal of Business Research* in 2008, and *MIS Quarterly* in 2011, and the *Academy of Marketing Science Review* in 2013. In spite of the extensive commentary and conceptual discussion about the appropriateness of the use of formative versus reflective scales, there has been little practical guidance and research available for researchers wishing to develop formative scales.

This paper presents a simple empirical example of a practical method to develop and validate a formative scale that addresses some of the criticisms and limitations of formative measurement. Edwards (2011) points out that whereas the development of reflective scales involves standardized steps and statistical tests for validation such as factor analysis for assessing construct validity or Cronbach's Alpha for internal consistency, these steps do not apply for formative scales. Selection of initial items for both reflective and formative scales involve similar steps such as a literature review and the judgment of experts, but steps to evaluate the appropriateness of a set of formative items are not nearly as clear or well established. Furthermore, Edwards (2011) points out that the weighting of items in a formative scale depends on the choice of other variables in the model which lead to problems of interpretation and lack of consistency between studies. The method outlined in this paper is intended to address the issue of empirically assessing the validity of formative items using objective criteria.

Our paper makes three main contributions to the literature on formative scale development. The first contribution is that we extend the work of Diamantopoulos and Siguaw (2006) and Christophersen and Konradt (2008) regarding the development of standardized steps for developing and validating a formative scale. Like these authors, we illustrate a method of jointly developing both a formative and reflective scale for the same construct as a way of jointly validating both scales. However, we extend the approach of these authors by utilizing a second-order measurement model for both the reflective and formative scales. More specifically, we measure the formative scale through second order formative dimensions each measured by first order reflective items. This second order approach has been proposed conceptually by Mackenzie, Podsakoff, and Jarvis (2005) and Mackenzie, Podsakoff, and Podsakoff, (2011). Similarly, Edwards (2011) has proposed a similar second order approach as a way of reducing measurement error for formative constructs. While such an approach has been proposed conceptually, little or no research has been done to illustrate such a method empirically.

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Second, this paper contributes to research on formative scale validation by using a relatively new path modeling technique called Generalized Structured Component Analysis (GeSCA) (Hwang and Takane, 2004). This method was designed to incorporate advantages of both traditional covariance based structural equational modeling (CBSEM) and partial least squares path modeling (PLS), and has some unique features that are ideal for formative scale development. More specifically, we employ the ability of GeSCA to estimate mixed-indicator measurement models with second order formative dimensions and first order reflective items. While studies have been done testing GeSCA's capabilities both Monte Carlo simulations (Hwang, *et al.,* 2010; Henseler, 2012) as well as empirical data (Tenenhaus, 2008), little or no research has been done utilizing GeSCA's second order measurement model capabilities.

A final contribution of this study is specific to the measurement of job satisfaction. This paper uses job satisfaction as an example for this method due to the common use of both formative and reflective items in measuring this construct, and because job satisfaction is a widely studied construct in organizational research. While the primary purpose of our study is to illustrate a generalizable method of formative scale development rather than to specifically investigate job satisfaction measurement, this study also provides useful data and results that shed light as to which formative aspects of job satisfaction line up the closest with commonly used reflective job satisfaction scales.

2. Literature Review

Coltman, et al. (2008) point out that while reflective measurement scales are dominant in psychology and management, the use of formative measurement scales are common in economics and sociology. A major conceptual difference between formative and reflective scales include the notion that in a reflective scale the direction of causality runs from the construct to the scale items, whereas in a formative scale the indicators cause the construct. All items in a reflective scale are expected to measure the full domain of the construct, and the meaning of the construct should not change if an item is removed. By comparison, in a formative scale each item is measuring a specific aspect of the construct and the domain of the construct will change if an item is removed.

A key empirical implication of a reflective scale is that all items should be intercorrelated since each item should be measuring the full domain of the construct. Traditionally, standard methods for evaluating measurement scales such as structural equation modeling, Cronbach's alpha, item response theory, or factor analysis have all assumed the use of reflective indicators (Bollen and Diamantopoulos, 2017). But given that formative scales do not need to be intercorrelated, these traditional methods will not be appropriate for validating a formative scale.

Diamantopoulos and Siguaw (2006) outline a four-step method for development of a formative scale. They illustrate these steps by identifying 30 items intended to measure export coordination. In order to divide these items into formative or reflective items, they use steps such as factor analysis or tests for multicollinearity. Items found to have a low degree of multicollinearity with each other are identified as formative, whereas items that load heavily on a single factor are identified as reflective. Finally, items chosen as formative were incorporated in a Multiple Indicators Multiple Causes (MIMIC) model to assess the correlation between these formative items and a latent variable measured by two reflective indicators of export coordination. Formative items were retained or removed based on optimization of the model fit.

Christophersen and Konradt (2008) use a similar approach as Diamantopoulos and Siguaw (2006) to jointly develop a formative and reflective scale to measure online store usability. However, Christophersen and Konradt's (2008) approach has two important differences with Diamantopoulos and Siguaw (2006). First of all, they establish a priori which items are expected to be formative and which ones are expected to be reflective rather than start with a common pool of items. This has the advantage of starting the process with an attempt to identify conceptually which formative aspects should be included in the scale. Second, instead of using a MIMIC approach they estimate separate reflective and formative scales. Validity of individual items are assessed in the formative scale by their statistical significance, and the validity of the formative scale is assessed by its path coefficient to the reflective scale of the same construct as well as the path coefficient to an outcome variable (purchase intention). A criticism of the MIMIC approach is that the interpretation can be difficult and it is not clear if the formative items "measure" the latent variable or are separate independent variables that predict a reflectively measured variable (Diamantopoulos, 2011). By estimating separate reflective and formative latent variables, the interpretation is clearer and the precise level of correlation between the two

scales can be measured. In addition, the ability of the formative and reflective scales to predict a criterion variable can be directly compared.

Edwards (2011) criticizes the use of formative measurement scales due to their inability, unlike reflective scales, to attenuate for measurement error. He proposes an alternative method whereby each formative item is measured by a multi-item reflective scale in a second order measurement model. This approach not only allows for formative items to be incorporated into a path model, but also allows for a combined reflective/formative approach that combines the advantages of both. Similarly, Mackenzie, Podsakoff, and Jarvis (2005) and Mackenzie, Podsakoff, and Podsakoff, (2011) propose the use of mixed-indicator second order measurement models with multiple formative dimensions each measured with a reflective scale. Christophersen and Konradt's (2008) approach does involve the use of multiple items to measure each formative aspect. However, instead of using a second order approach they first reduce the number of items in their formative scale using factor analysis.

Christophersen and Konradt (2008) use Smart-PLS for their model estimation, which does not allow for second order measurement models and thus the Edwards (2011) approach cannot be applied. While most other PLS software packages have built in formative latent variable features, they typically do not have second order measurement model capabilities. Generalized Structured Component Analysis (GeSCA) software (Hwang and Park, 2009) allows for second order latent variable computation, and thus it can be used to implement Edwards' (2011) method.

Diamantopoulos (2011) points out that it is a common misperception that only PLS can estimate formative latent variables and that this cannot be done using CBSEM. He outlines an approach to estimating formative latent variables using CBSEM and points out several advantages of using CBSEM over PLS such as the ability for CBSEM to compute fit statistics and thus better refine the formative measurement model. However, he also points out several challenges of formative measurement with CBSEM such as identification issues and the need to use programming language to implement some formative estimation techniques. Unlike PLS, GeSCA does compute a fit statistic but retains advantages of PLS such as built-in formative measurement capabilities, a lack of identification issues, and low sample size requirements (Hwang and Takane, 2004). Thus GeSCA is an attractive option for development of formative measurement scales. The next section of this paper will outline our methodological approach for evaluating a hybrid reflective/formative measurement model using GeSCA.

3. Methodology

3.1 Study Population

This study was conducted utilizing U. S. military, NATO and Department of Defense civilian personnel throughout the Naples, Italy area during May and June of 2012. While this is a narrow and specialized sample, it does have its advantages for collecting job satisfaction data in that the military is one of the only large organization that tends to have required or obligated service. This means that unlike most civilians, they cannot leave a job that they dislike until their fixed term of employment ends. So unlike civilian populations, a military oriented population may have less of a sample selection bias issue resulting from unhappy employees leaving their jobs. Harvey, Billings and Nilan (1985) used National Guard members in a similar fashion when evaluating the Job Diagnostic Survey.

3.2 Formative Indicator Selection

The sources of reflective and formative job satisfaction items are adopted from five commonly utilized job satisfaction measurement instruments which include, the Minnesota Satisfaction Questionnaire (MSQ), the Job Descriptive Index (JDI), the Job Diagnostic Survey (JDS), the Michigan Organizational Assessment Questionnaire-Job Satisfaction Subscale (MOAQ-JSS), as well as the Job Satisfaction Survey (JSS) (see Van Saane, et al. (2003) for a review of these instruments).

Table 1 below gives an overview of the facets covered in these scales. The most commonly used items involve pay, coworkers, growth, supervision, and general reflective items. The MSQ covers 20 different formative aspects, but the other instruments are far more parsimonious. The JSS includes nine formative aspects, and the remaining three include five facets each.

Table 1: Job Satisfaction Survey Indicators

MSQ	JDI (JIG)	JDS	JSS	MOAQ-JSS
Ability Utilization				
Achievement				
Activity	Work		Nature of Work	
Advancement	Promotion		Promotion	
Authority				
Company policies				
Compensation	Pay	Pay	Pay	Extrinsic Rewards
Coworkers	Coworkers	Social	Coworkers	Interpersonal Relations
Creativity				
Independence				
Moral Values				
Recognition			Contingent Rewards	
Responsibility				
Security		Security		
Social service				
Social status				
Supervision (Human relations)	Supervision	Supervisor	Supervisor	
Supervision (technical)				
Variety				
Working Conditions			Operating Conditions	Work Environment
		Growth		Intrinsic Rewards
			Communication	
			Fringe Benefits	
				Miscellaneous
	JIG-General	General	Global	JSS-General

Three items for each formative aspect were selected and/or adapted with permission, from an item pool of current scales to represent each of the selected formative indicators. The formative indicators were measured using a seven-point Likert scale ranging from Very Dissatisfied to Very Satisfied. Each statement is prefaced with "At this job, this is how I feel about…".

3.2.1 Pay

All five instruments listed in Table 1 include pay as a formative facet of job satisfaction. Thus it is a relatively straight forward decision to include pay as one of our formative aspects. We include two items directly related to pay and one item related to benefits. Appendix I includes a list of our formative items and the source of the items – most of which come from the MSQ, JDI, and JSS.

3.2.2 Social

Besides pay, the only other formative facet shared by each of the five instruments in Table 1 relates to coworkers or the "social" aspect of the workplace. We include Social as a formative aspect that encompasses items related to coworkers, community, and working relationships.

3.2.3 Supervision

Four of the five instruments in Table 1 measure some form of satisfaction with supervision. Thus this facet is also a natural choice for inclusion. We include items related to perceived support from the supervisor, praise for good work, and competence of the supervisor.

3.3 Work and Growth

While there is broad convergence among the instruments we reviewed in covering coworkers, pay, and supervision there is considerable divergence regarding other facets of job satisfaction to include. Facets related to work, the working environment, and promotion each measured in three of the instruments in Table 1. Two other facets were measured by two instruments – these facets are related to growth and to job security. We elected to select three items directly related to everyday tasks regarding the work itself based on items found in work or working environment scales and label this facet as Work. And finally, we elected to take items related to promotion, growth, and job security as the Growth facet of job satisfaction. Promotion and growth have been linked as "motivator" aspects of job satisfaction. Furthermore, job security and growth have been linked together in the psychological contract literature as "relational motivators" as opposed to "transactional motivators" that are monetary in nature such as pay and benefits. (Robinson, Kraatz and Rousseau, 1994; Shore and Tetrick, 1994). Taken together, the items related to job security, growth, and promotion can also be considered part of the long-term potential of the employee at the organization.

3.4 Reflective Indicator Selection

Reflective indicators vary depending on the measurement model or the structural model being applied. The first type of reflective indicator is the single item answer, "All in all I am satisfied with my job." The single item response will be used to test various assumptions and models. The second type of indicator is the adapted JIG, which was amended from the Y/N format to a 7 point Likert scale premised with "At this job, my work is usually…" This phraseology follows the original design, with only the response format differing. The third type of indicator will be the trio of responses from the MOAQ-JSS also on a 7-point Likert scale. Both the adapted JIG, and the MOAQ-JSS will act as reflective indicators for the latent variable as illustrated in the composite model in Figure 2.

3.5 Structural Model Dependent Variable

A three-item scale was used to measure Intent to Leave: "I often think of leaving the organization," "It is very possible that I will look for a new job next year, or as soon as possible after my current commitment" and "If I may choose again, I will choose to work for the current government organization." These items were taken were adopted from a scale originally developed by Cammann, *et al.* (1979) which was also shown to have validity/reliability in additional studies (Chen, Hui and Sego, 1998; Valentine, *et al.,* 2011). Minor modifications were made to the second and third questions to reflect the nature of our military sample population.

3.6 Statistical Analysis

As previously explained, GeSCA is one of the few path modeling packages that allows for second order measurement models and has built-in formative measurement model capabilities. GeSCA is the primary statistical method used to estimate our model. Figure 1 illustrates the basic reflective/formative modeling approach used by Christophersen and Konradt (2008). Figure 2 illustrates the approach we use to estimate our model. This includes five formative aspects at the first order level, each measured by multiple reflective indicators. For the purely reflective scale, we also employ a second order approach with the JIG and MOAQ-JSS scales used at the first order level and each measured by multiple reflective indicators at the second order level. The three item Intent to Leave scale serves as the outcome variable in this model.

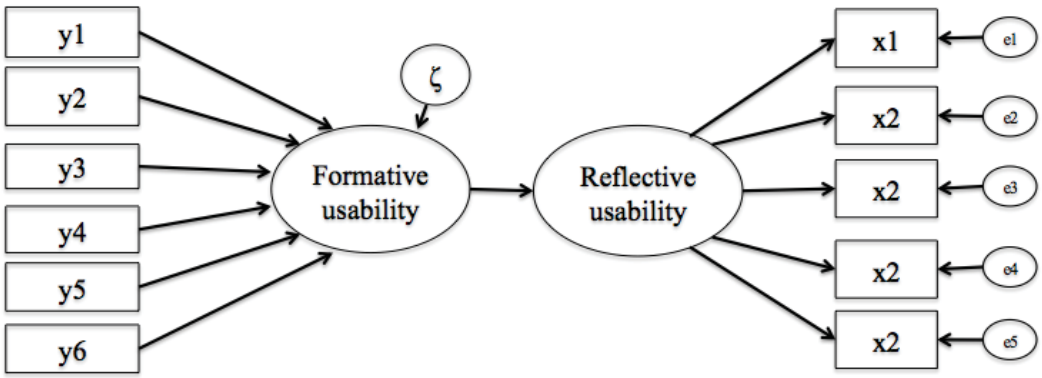

Figure 1: Christophersen and Konradt Reflective/Formative Measurement Model Approach

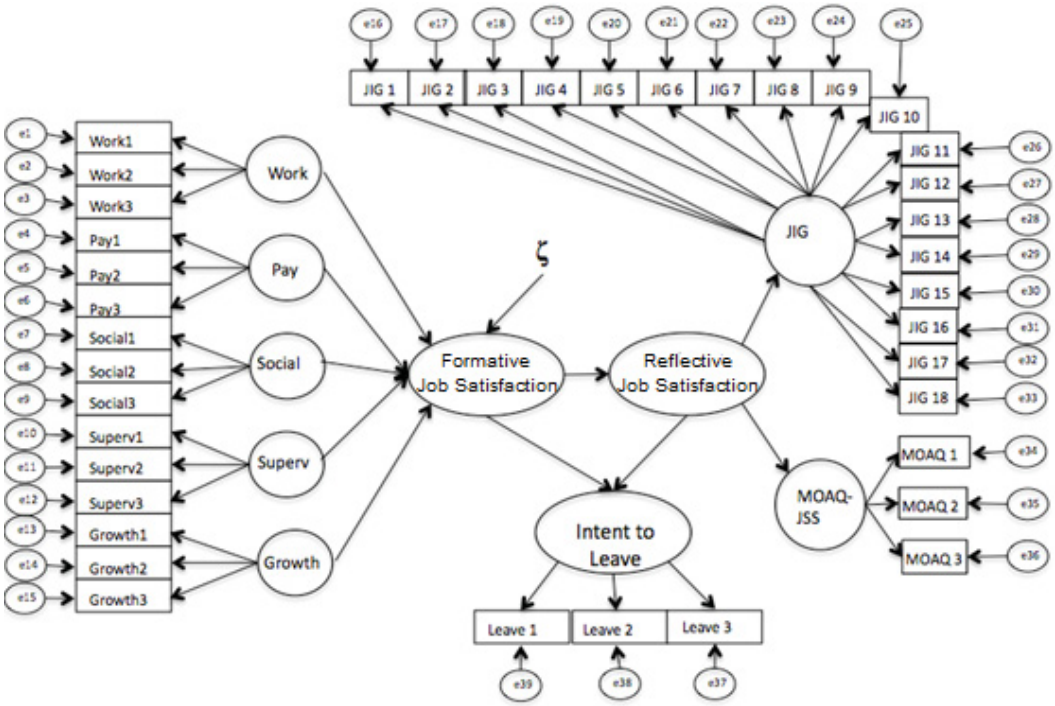

Figure 2: Second Order Reflective/Formative Job Satisfaction Measurement Model

3.7 Halo Effect

Minimizing a potential halo effect was a concern due to development of our formative scales, as a strong halo effect might lead to artificially high correlations between formative aspects and thus multicollinearity. Multicollinearity can bias formative scale estimation (Diamantopoulos and Winklhofer, 2001). Items were then grouped according to each indicator, and not mixed throughout the survey, allowing the individual to concentrate on each conceptualization or subscale before moving to the next idea (Garbarino and Johnson, 1999). Finally, all items were modified to align with a 7-point Likert scale allowing for a larger range of response with greater nuance as recommended by Bownas and Bernardin (1991).

4. Results

4.1 Descriptive Statistics

Of over 320 completed surveys, 307 were considered valid and usable for the study. The population was divided evenly between junior and senior personnel in which enlisted ranks and civilians below the GS-7 pay grade are considered the Junior population, GS-9 civilians or higher were grouped with all officer ranks and designated as Senior in Table 2. In general, most rated their job satisfaction at a level slightly above the neutral of 4 with Senior individuals more satisfied that Junior personnel and less likely to leave. However, the standard deviations in several areas are high, illustrating that those who weren't ambivalent tended to either love or hate their jobs.

Table 2: Positional

		JIG	MOAQ-JSS	ITLeave	Work	Pay	Social	Superv	Growth
Junior	**Mean**	**4.7378**	**4.5381**	**4.0109**	**4.5882**	**4.4401**	**4.4684**	**4.3486**	**3.9107**
	N	153	153	153	153	153	153	153	153
	Std. Deviation	1.35961	1.78121	1.87216	1.44882	1.38055	1.5109	1.86117	1.54655
Senior	**Mean**	**5.0592**	**5.0217**	**3.658**	**4.8745**	**5.1061**	**4.9091**	**4.7619**	**4.6991**
	N	154	154	154	154	154	154	154	154
	Std. Deviation	1.3383	1.70424	1.84156	1.42142	1.4665	1.39783	1.6342	1.4867
Total	**Mean**	**4.899**	**4.7807**	**3.8339**	**4.7318**	**4.7742**	**4.6895**	**4.5559**	**4.3062**
	N	307	307	307	307	307	307	307	307
	Std. Deviation	1.35634	1.75694	1.86224	1.43995	1.46058	1.46956	1.76034	1.56498

There was little variation between the military and civilian counterparts as seen in Table 3, although civilians were slightly more satisfied in all areas except Growth. This may be

because there tend to be fewer opportunities for advancement for civilians who would prefer to remain in one area or in one field of expertise. The commands with the highest levels of satisfaction were JFC/NATO at an average of 5.21 and Other Naples Areas at an average of 5.17, who consisted of individuals based in Naples at a different commands or units aside from the larger groups. The one ship included in the study had the lowest overall levels of satisfaction averaging 3.11.

Table 3: Pay Structure

		JIG	MOAQ-JSS	ITLeave	Work	Pay	Social	Superv	Growth
Military	**Mean**	**4.7233**	**4.626**	**3.9499**	**4.6322**	**4.7793**	**4.6541**	**4.4476**	**4.3365**
	N	213	213	213	213	213	213	213	213
	Std. Deviation	1.40883	1.78376	1.86623	1.44205	1.41637	1.45759	1.7049	1.54865
Civilian	**Mean**	**5.2973**	**5.1312**	**3.5709**	**4.9574**	**4.7624**	**4.7695**	**4.8014**	**4.2376**
	N	94	94	94	94	94	94	94	94
	Std. Deviation	1.13907	1.65062	1.83594	1.41694	1.56395	1.50112	1.86608	1.60764
Total	**Mean**	**4.899**	**4.7807**	**3.8339**	**4.7318**	**4.7742**	**4.6895**	**4.5559**	**4.3062**
	N	307	307	307	307	307	307	307	307
	Std. Deviation	1.35634	1.75694	1.86224	1.43995	1.46058	1.46956	1.76034	1.56498

The highest levels of satisfaction by ranked groups are the Civilian Senior Supervisors (5.74), Junior Civilians (5.35), and Civilian Senior Managers (5.29). The lowest levels of satisfaction were Civilian Supervisors (4.20), and Junior Enlisted personnel (4.39). Strangely, while Civilian Supervisors were the least satisfied, they were also the least likely to leave. Junior Enlisted personnel were the most likely to leave for another job. In general, women were on average more satisfied (ranging 5.08-5.14) then men (ranging 4.71-4.84) and slightly less interested in leaving, 3.41 compared to 3.94.

Table 4 shows the overall averages for the formative job satisfaction aspects with satisfaction being strongest with Pay and lowest in Growth, for the entire sample. Overall intentions to leave were slightly lower than neutral at 3.83 indicating a general confidence in remaining with government service. However, it should be noted that with a standard deviation of 1.86 there appears to be little ambivalence toward the decision.

Table 4: Formative Indicator Results

		JIG	MOAQ-JSS	Work	Pay	Social	Superv	Growth
Total	***Mean***	**4.899**	**4.7807**	**4.7318**	**4.7742**	**4.6895**	**4.5559**	**4.3062**
	N	307	307	307	307	307	307	307
	Std. Deviation	1.35634	1.75694	1.43995	1.46058	1.46956	1.76034	1.56498

4.2 Model Testing

Cross loading analysis was conducted to assess the discriminant validity of the scales and can be seen in Table 5. Overall the loading patterns indicate strong convergent and discriminant validity of the scales with most items loading above .7. The item JIG3 was the only item that illustrated a low loading on the JIG construct, but it still had a higher loading on the JIG construct than for any of the other scales indicating that it still related primarily to only the JIG. It also had poor path coefficients throughout all of the models, however because the JIG is being utilized in its entirety as a previously validated scale, the item has not been removed in this study in order to maintain consistency. Both the MOAQ-JSS and the JIG are utilized throughout in their entirety in order to maintain integrity and reliability. The JIG asks the individual to consider their current job in general and "all in all, what is it like most of the time?" Item number 3 is the statement "Ideal", which considering the military community, may be identifying independently from the actual levels of satisfaction. In other sample populations this term may have less resistance. The JIG4, "Waste of Time," and JIG14, "At this job, all in all my work is usually…Inadequate," were the next lowest loading of all the items in the study. This could possibly correspond to a sense of duty overriding feelings of job satisfaction in general.

Table 5: Crossloading Matrix

	MOAQ	JIG	Pay	Social	Supervision	Work	Growth	Intent Leave
MOAQ1	**0.9416**	0.7903	0.5230	0.7436	0.7029	0.7860	0.5921	-0.7398
MOAQ2	**0.8938**	0.7062	0.4547	0.6171	0.6117	0.6610	0.5000	-0.7155
MOAQ3	**0.9022**	0.7311	0.5203	0.6565	0.6055	0.7364	0.5251	-0.6942
JIG1	0.7003	**0.8297**	0.3656	0.5926	0.5658	0.6907	0.4493	-0.5698
JIG2	0.6580	**0.7969**	0.3334	0.5328	0.5704	0.5945	0.4202	-0.5435
JIG3	0.3260	**0.3821**	0.1903	0.2696	0.2393	0.3051	0.2512	-0.2443
JIG4	0.5190	**0.6785**	0.2508	0.3671	0.4109	0.5236	0.3193	-0.4318
JIG5	0.6495	**0.8194**	0.3379	0.5413	0.5395	0.6328	0.4101	-0.5479
JIG6	0.6022	**0.8046**	0.2577	0.4869	0.5366	0.5991	0.3729	-0.4731
JIG7	0.6432	**0.7745**	0.3838	0.5127	0.5066	0.6050	0.4076	-0.5441
JIG8	0.6731	**0.8292**	0.3046	0.5111	0.5170	0.6324	0.3934	-0.5276
JIG9	0.6315	**0.8222**	0.3408	0.5622	0.5230	0.5969	0.4228	-0.5004
JIG10	0.6344	**0.7563**	0.3399	0.5646	0.5174	0.6007	0.4208	-0.5057
JIG11	0.6406	**0.7830**	0.3186	0.4996	0.5058	0.5586	0.4131	-0.5036
JIG12	0.6653	**0.8194**	0.3103	0.5073	0.4977	0.6018	0.4192	-0.5247
JIG13	0.6337	**0.7414**	0.2890	0.5045	0.4856	0.6544	0.3482	-0.4959
JIG14	0.5316	**0.6802**	0.2239	0.4601	0.4590	0.4779	0.3550	-0.4197
JIG15	0.6616	**0.8415**	0.3189	0.5519	0.5130	0.6471	0.4478	-0.5712
JIG16	0.6669	**0.8320**	0.2682	0.5428	0.5430	0.6045	0.3850	-0.5242
JIG17	0.7512	**0.8635**	0.4209	0.6301	0.5727	0.7418	0.4801	-0.6243
JIG18	0.7310	**0.8629**	0.3428	0.5897	0.5811	0.6753	0.4454	-0.6079
PAY1	0.4692	0.3551	**0.8745**	0.3772	0.3216	0.4193	0.4648	-0.3730
PAY2	0.4418	0.3164	**0.7757**	0.3906	0.3432	0.3863	0.4910	-0.4505
PAY3	0.4697	0.3441	**0.8704**	0.3879	0.3559	0.3923	0.4667	-0.4045
SOCIAL1	0.5678	0.5080	0.3315	**0.8254**	0.5763	0.6103	0.4604	-0.4735
SOCIAL2	0.6802	0.6113	0.4143	**0.9161**	0.7304	0.6724	0.5417	-0.5795
SOCIAL3	0.6413	0.5797	0.4247	**0.8240**	0.6249	0.6342	0.5852	-0.5758
SUPERV1	0.6487	0.6145	0.3655	0.6882	**0.9198**	0.6481	0.4886	-0.5772
SUPERV2	0.6519	0.5795	0.3999	0.7026	**0.9375**	0.6336	0.5348	-0.6003
SUPERV3	0.6514	0.6213	0.3601	0.7094	**0.9205**	0.5917	0.5339	-0.5716
WORK1	0.6697	0.6462	0.4475	0.6459	0.5901	**0.8524**	0.4578	-0.5409
WORK2	0.7752	0.7500	0.3917	0.6896	0.6142	**0.8862**	0.4924	-0.6690
WORK3	0.5718	0.5566	0.3778	0.5604	0.5084	**0.8140**	0.3865	-0.4662
GROWTH1	0.5283	0.4609	0.4983	0.5464	0.5007	0.4850	**0.9251**	-0.5117
GROWTH2	0.5342	0.4623	0.5076	0.5487	0.5306	0.4761	**0.9000**	-0.5332
GROWTH3	0.4684	0.4042	0.4543	0.5136	0.4141	0.4014	**0.7561**	-0.4463
LEAVE1	-0.6593	-0.5764	-0.3861	-0.5610	-0.5603	-0.5849	-0.4985	**0.8886**
LEAVE2	-0.5547	-0.4470	-0.3541	-0.4546	-0.4473	-0.4674	-0.4236	**0.8362**
LEAVE3	-0.7559	-0.6317	-0.4828	-0.5882	-0.5764	-0.6216	-0.5321	**0.8227**

Overall the discriminant validity appears to be strong in which each of the designed scales as well as those of the previously published JIG and MOAQ-JSS. Due to discriminant validity between the JIG and MOAQ-JSS scales we modelled reflective job satisfaction as a second order construct rather than merge the two scales as one. Figure 3 below presents the model results. For brevity sake only the second order weights and loadings are shown for the formative Specific Satisfaction scale and the reflective General Satisfaction scale. First order loadings (not shown in the figure) were all over .7 except for three items in the JIG scale, two of which were over .6. As expected, the coefficient between the formative and reflective job satisfaction scales is very high at .867. The coefficients between the two job satisfaction latent variables and Intent to Leave are both negative as

expected and significant at the 1% level. However, the reflective latent variable has a larger coefficient of-0.536 compared to -0.274 for the formative scale.

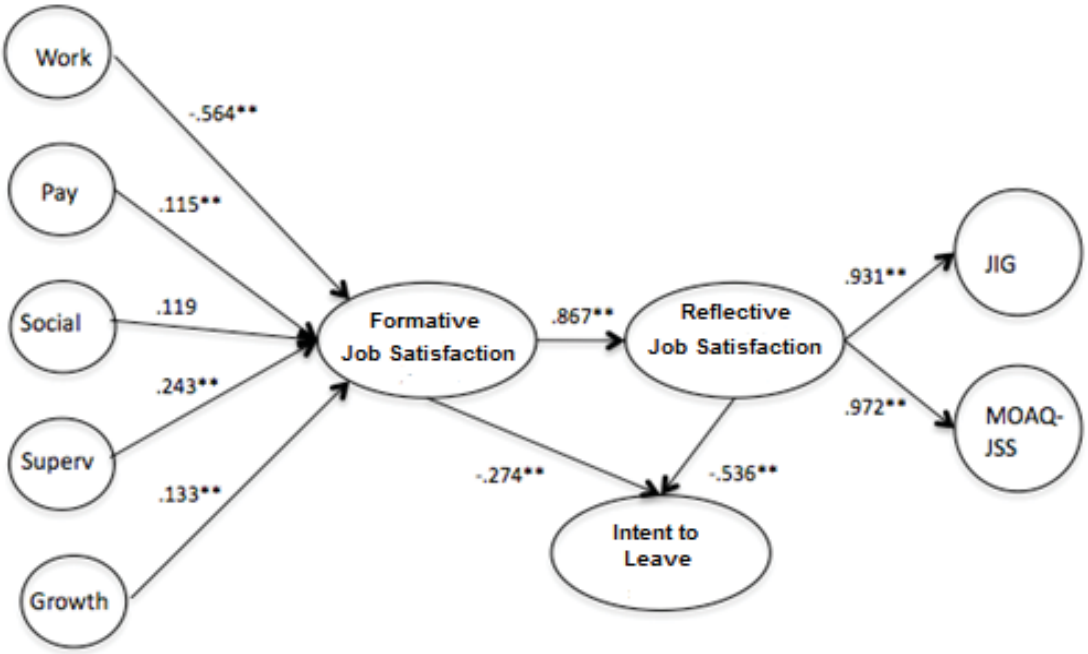

Figure 3: Model Results

Some interesting results were found concerning the weights of the five formative indicators. All weights were significant at the 1% level except for Social which was positive and similar in magnitude to Supervision and Pay but failed to reach significance. An unusual result is that the weighting for Work is negative. However, this appears to be an anomaly within GeSCA as the factor loadings for the reflective items used to measure Work were also negative so the negative signs cancelled out. Work appears to be the strongest formative contributor with a weighting of -.546 which should be interpreted as positive due to the GeSCA anomaly.

While job satisfaction was chosen primarily for illustrative purposes, an interesting result was found that the Social aspect was not found to be significant. Social includes commonly used items in job satisfaction such as relationships with coworkers, so this result is surprising. Given that the sample was a specific one involving military employees, limited generalizability should be given to this result. However, this result is still interesting in that it shows that even with constructs as widely used as job satisfaction it is still not necessarily clear what formative aspects align with the reflective aspects. Furthermore, this result is consistent with at least some prior analysis of formative job satisfaction scales. Kinicki, et al. (2002) and Buckley et al. (1992) used meta-analysis and multitrait-multimethod matrix analysis to assess the comparative validity of the five facets of the JDI, and found coworkers to have the lowest validity of these five facets. Future research using different sample populations can help better refine which formative aspects of job satisfaction should be included both in measurement scales and in the conceptual definition of job satisfaction.

Another interesting result is that the reflective job satisfaction scale had a much larger coefficient when predicting intention to leave than the formative job satisfaction scale. This may be due the fact that the reflective scale involves attenuation for measurement error at both the second and first order level, whereas the formative scale only attenuated for measurement error at the first order level. The result suggests that for pure accuracy of measurement and predictive power, reflective scales may be preferable. However, formative scales also provide more practical information to researchers or practitioners. For example, the formative job satisfaction scale could be used by management to see what formative aspects of job satisfaction such as satisfaction with work or satisfaction with supervision can be improved in order to improve retention. The benefits of the accuracy of reflective scales and the detailed information provided in formative scales is a further argument in favor of joint development of formative and reflective scales along the lines of the method presented in this paper.

5. Conclusion

Methodologically this paper has contributed to the literature by providing an empirical example of the hybrid approach of measuring a scale formatively at the first order level and reflectively at the second order level as proposed by Edwards (2011). The results indicate that this technique is relatively easy to implement and generally provided results that were expected. GeSCA was overall effective other than one anomaly that was easy to interpret and didn't impact the overall results. While this study used job satisfaction for illustrative purposes, future researchers designing a new scale can use this technique to validate a set of chosen formative indicators. Researchers choosing to use existing formative scales may also wish to utilize GeSCA to measure formative latent variables using formative items at the second order level and reflective items at the first order level.

The method in this study has potential to be an improvement over other scale development methods. First of all, Cronbach's alpha, average variance explained and other validity/reliability statistics for reflective scales do not apply to formative scales. In place of these statistics, this method has shown how the statistical significance of each formative aspect in the GeSCA model can be used to assess the validity of each aspect. For example, the lack of significance of the Social formative aspect shows that even widely used formative job satisfaction aspects may not have validity when included in a full model with both formative and reflective scales. Second, this method allows for the joint development of both a reflective and formative scale simultaneously. The result that both the formative and reflective job satisfaction scales correlate high with each other as well as with intent to leave gives a high level of confidence for both scales. For these reasons, new scales can be developed and existing formative scales can be re-evaluated using the method in this paper.

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Appendix I: Formative Scale Items

All items prefaced by "At this job, this is how I feel about…".

Item	**Source**
Pay	
-"The amount of pay for the work I do"	Adopted from MSQ
-"How my pay compares with that for similar jobs in other companies"	MSQ
-"The benefits I receive (medical, leave, retirement, etc.)"	JSS
Coworkers	
-"The way my co-workers get along with each other"	MSQ
-"The amount of helpfulness provided by the people with whom I work"	Adopted from MSQ and Teacher Job Satisfaction Questionnaire
-"The chance to be 'somebody' in the community"	MSQ
Supervision	
-"The way my boss backs up his/her employees (with top management)"	MSQ
-"The way my supervisor praises good work."	JDI
-"The level of competence my supervisor has in doing his/her job."	JSS
Work	
-"The working conditions"	MSQ
-"The sense of accomplishment work gives me"	Adopted from JDI and MOAQ-JSS
"The amount of work expected of me"	Adopted from JSS and MSQ
Growth	
-"The opportunities for promotion."	JDI
-"When people do well on the job they have a fair chance of being promoted."	Adopted from JSS
-"My job security."	MSQ