

# Validating Originality, Efficiency and Rule Conformity Sub-Scales in the Adaptor-Innovator in the Workplace Measure

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## Abstract

Researcher demand for cognitive style measures is based on individual differences and the need to determine their influence. Several researchers have examined how individuals who desire to “do things better”, termed adaptors, differ from those who desire to “do things differently, termed innovators. How these two groups vary with regards to information systems provides insight into many aspects of information technology including, development, training, implementation and use. While the basic Adaptor-Innovator in the Workplace (AI-W) scale has been validated, there is a need to extend this measure and test for the existence of three distinct sub-scales. This work attempts to extend the AI-W scale and validate the existence of individual approach to efficiency, rule governance and sufficiency of originality so that other researchers may use this scale in future work. Initial results indicate the existence of the sub-scales providing a foundation for future work.

Keywords: Cognitive Style, Adaptor, Innovator, Adaptor-Innovator in the Workplace Measure, Originality, Efficiency, Rule Conformity

## 1. Introduction

The Kirton Adaptor Innovator Index (KAI) has a long proven history in cognitive style research (Kirton, 1976, Kirton, 1980, Hayward and Everett, 1983, Kirton and McCarthy, 1988, Kirton et al., 1991, Clapp, 1993, Kirton, 2003). Researcher demand for cognitive style scales is based on individual differences and the need to determine their influence (Wang *et al.*, 2005). Unfortunately, the KAI is proprietary and it requests substantial resources to obtain certification to use this measure.

Xu and Tuttle realized the need for this cognitive style measure and developed an alternative, the Adaptor Innovator in the Workplace (AI-W) scale (Xu and Tuttle, 2004a). Several researchers have used this scale to determine individual differences in work styles (Xu and Tuttle, 2004b), differences in performance during computer learning (McLeod *et al.*, 2008), and social issues in accounting performance (Xu and Tuttle, 2005). To better understand the AI-W scale and extend its potential use amongst researchers, continued conceptual analysis, empirical testing and continued research efforts are needed (Chakraborty *et al.*, 2008).

This research evaluates the AI-W for three sub-scales, Approach to Efficiency, Rule Governance and Sufficiency of Originality by performing exploratory factor analysis in a government employee setting. Results indicate that a three sub-scale model exists and that a 9 item scale demonstrates adequate reliability and validity.

The remainder of this paper is divided as follows; section two discusses the Adaptor Innovator literature, section three details the foundations of the new Adaptor Innovator in the Workplace measure, section four puts forth our methodology, section five reports results and limitations, and section six concludes.

## 2. Adaptor-Innovator Literature

Cognitive style refers to an individual's consistent preferences in organizing and processing information (Messick, 1994). It is an individual trait that is general across tasks and enduring over time (Bostrom *et al.*, 1990). Cognitive style is different from strategy, that is task specific (Bostrom *et al.*, 1990) and conscious decision making approaches, that is choosing from alternatives (Messick, 1994). It is also independent of ability (Kirton and Deciantis, 1986, Messick, 1994). Abilities are competencies and often limited to particular domains of content. In contrast, cognitive styles are propensities and are consistent over time and situations. Cognitive styles are typically bipolar (Messick, 1994). Kirton (Kirton, 1976) identifies a bipolar dimension with the habitual adaptor at one end of the scale and the habitual innovator at the opposite end.

The original foundations of Adaptor-Innovator Theory were based on work by Peter Drucker (1969), who claimed that when managers and bureaucrats faced predicaments, two basic problem solving approaches emerged. Kirton (1976) proposed that this basic tenet applied to all people and that anyone could be located on a continuum, ranging from "doing things better" to "doing things differently". He labeled the ends of the continuum adaptive and innovative and suggested that personalities of people range from very adaptive to very innovative. Thus, some people habitually adapt (do things better) while some habitually innovate (do things differently).

Adaptor characteristics include precision, reliability, and efficiency. They are concerned with resolving problems rather than finding them and seeking solutions within existing paradigms by being safe, sound, and reliable.

Personalities of Innovators include a lack of discipline while approaching tasks from unusual angles. They tend to discover problems and prefer thinking outside the box. They will take control in unstructured situations and have a low tolerance for routine work, and challenge rules.

Kirton developed and validated the Adaptor-Innovator scale from a descriptive typology. It is a 32-item questionnaire that measures people's tendency on the adaptor-innovator bipolar scale. Each item uses a five point Likert scale; Adaptors score on the low end and Innovators score on the high end of the continuum. This scale measures individual differences in cognitive style manifestations in any creativity, problem-solving, or decision-making behavior. It can be widely applied in organizational settings such as in the context of recruitment, training, task performance, personnel selection, team composition, organizational fit, career guidance and counseling (Hayes and Allinson, 1994), as well as consumer adoption of new foods (Foxall and Haskins, 1986) and computers (Foxall and Bhat, 1991).

### 2.2 Factor Analysis, Sub-Scale Development, Reliability and Validity

AI theory has a long cognitive style research history and its validation and reliability have been through several challenges. The KAI was originally developed to measure individuals' preferences on a single dimension, the adaptor-innovator dimension. Factor analysis indicates that a three-subscale structure exist, with the three subscales being Originality, Methodical Weberianism, or being precise and disciplined, and Mertonian Conformist, or respect for rules and authority (Kirton, 1976). Taylor (Taylor, 1989a) suggested that while considerable evidence had accumulated establishing validity and psychometric properties of the AI scale, factor analysis produced orthogonal sub-scales. This line of analysis continued in a subsequent article by Taylor (Taylor, 1989b) questioning whether a three, four or five factor model was more effective. Taylor's work supported the existence of three factors: Originality, Efficiency, and Rule Conformity. Bagozzi and Foxall (1995) used confirmatory factor analysis to challenge the unidimensionality of the KAI. Strong evidence indicated three distinct factors exhibiting both convergent and discriminant validity.

## 3. Adaptor-Innovator in the Workplace

The KAI scale is not easily used in academic research because of its costs. To administer the scale, researchers must attend a week of training, become certified and purchase a minimum number of surveys. Building on the work of Summers, Sweeney and Wolk, Xu and Tuttle (2004a) developed a new measure of Adaptor-Innovator problem solving style applicable to the work place. Xu and Tuttle consolidated and refined the factors resulting in a 7 item scale. They assessed reliability using two samples. In the first sample (n = 106) business school sophomores with limited work experience completed the measure. Cronbach's alpha was satisfactory (r = 0.753). Factor analysis suggested a single factor with an Eigenvalue of 2.950. The second sample consisted of business school senior level accounting students (n = 25) with more work experience. Cronbach's alpha was 0.850 and factor analysis suggested

one factor with an Eigenvalue of 3.740. The two samples suggested that the AI-W was adequate to warrant further examination of validity.

The authors employed similarity attraction theory (Byrne, 1961) to establish convergent validity. The theory proposes that behavior of another individual is positively reinforcing to the extent that it is similar to one's own. The more reinforcement one gets, the more attraction one feels. Sample three consisted of university juniors completing the AI-W. They evaluated a subordinate's performance and classified them as either similar or dissimilar to the subordinate based on their AI-W classification. Consistent with similarity theory, the participants favored similar subordinates, validating the AI-W scale and providing evidence of construct validity. Discriminant validity was assessed using Locus of Control (Spector, 1988). Correlation between the scores of the two measures was -0.22, indicating good discriminant validity.

Sample four included 139 MBA students who functioned as evaluators in a superior-subordinate relationship. Researchers determined their work place problem solving style using the AI-W measure. Factor analysis suggested a single factor Eigenvalue = 4.099 (alpha = 0.92). Results show that greater similarity between superior and subordinate, the greater the attraction. The ability of the scale to predict results is an indication of construct validity.

This new measure of Adaptor-Innovator trait is not proprietary, well suited for the work place, and much shorter than the original thirty-two item scale. Xu and Tuttle state that this measure is reliable and demonstrates good construct validity, making it useful for measuring human factors when using objective performance measures. However because of its newness, the recognized AI subscales; Originality, Efficiency and Rule Conformity have not been validated. This study focuses on Xu and Tuttle's AI-W (2004b), new Adaptor Innovator scale to measure problem solving style in the work place and evaluates the validity of three subscales as shown in Figure 1.

#### 4. Methodology

To test the existence of subscales in the AI-W, two additional items were added to the original seven item measure by Xu and Tuttle (Xu and Tuttle, 2004a). This allowed for the examination of three sub-scales similar to the KAI. We tested these items by surveying municipal government paramedics working in the southwestern U.S. After soliciting management's support, these government employees received requests for participation via email, which included a link to an online survey. Respondents who consented to participate, read Internal Review Board notices before beginning the survey. We solicited demographic information and AI-W survey responses. Participants who failed to respond after two weeks received personalized emails requesting involvement. After one month, a summary of participation occurred to determine the number of valid surveys collected.

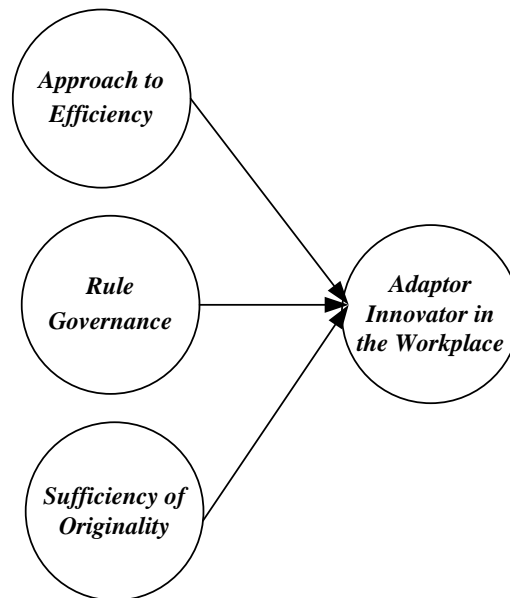


Figure 1 - Three Sub-Scale Model of AI-W

#### 4.1. Demographics

Included in our survey were respondent age, gender, education, and computer work experience. Ninety five employees participated and 87 completed both the demographic and cognitive style portions of the survey, resulting in a response rate of 92%. Seventy-seven (89%) of the participants were male, and ten (11%) of the participants were female. The disparity between males and females was expected since this group of government workers has been male by self-selection. Table 1 details gender responses of the participants.

**Table 1 - AI-W Gender Demographics**

Gender	N	AI-W	
Female	9	Adaptors	2
		Innovators	7
Male	78	Adaptors	34
		Innovators	44

Females were predominately Innovators. Seven females classified as Innovators and two as Adaptors. Males were split with Adaptors numbering 34 and innovators 44. The participants fell into four age brackets with 21-30 comprising only 1%, 31-40 making up 18% of the respondents, 50% were 41-50 and 30% falling between 51-60. We also collected educational level of respondents. Bracketing by educational level split potential responses into six categories High School/G.E.D 2%, Some College 47%, Associates Degree 24%, Bachelors Degree 23%, Masters Degree 3%, and Doctorate Degree 0%. Respondent’s computer work experience was bracketed by year into the following six categories, 0-1 – 11%, 2-3 – 6%, 4-5 – 12%, 6-7 – 15%, 8-9 – 8%, and >10 – 48%. Given the respondents’ average age, it was not surprising that the majority reported greater than ten years of computer work experience.

**5. Results**

The participants completed the Adaptor Innovator-Workplace inventory to determine their problem solving preference. The range for the continuum was 9 to 81. This produced a theoretical mean of 45. AI-W score results for the participants ranged from 9 to 65, with a mean of 38.34 and a standard deviation of 11.72.

**Table 2 - Scale Reliability**

	Cronbach's Alpha	N
AE	0.73	3
RG	0.82	3
SO	0.76	3

Of the 87 participants, 36 scored as Adaptors and 51 scored as Innovators. After administering the extended AI-W measure, the data were factor analyzed by principal component analysis followed by Varimax rotation, using SPSS 16.0. Scale reliability was shown by all three scales achieving a Cronbach’s Alpha greater than 0.70. These reliabilities are detailed in Table 2.

**Table 3 – Item-Total Statistics**

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted

AE1	7.16	11.16	0.52	0.67
AE2	7.56	10.18	0.62	0.54
AE3	7.85	12.38	0.50	0.69
RG1	8.13	14.25	0.70	0.73
RG2	8.69	16.22	0.69	0.75
RG3	8.43	13.78	0.65	0.79
SO1	10.24	17.80	0.44	0.83
SO2	10.02	14.36	0.64	0.62
SO3	10.16	13.43	0.70	0.53

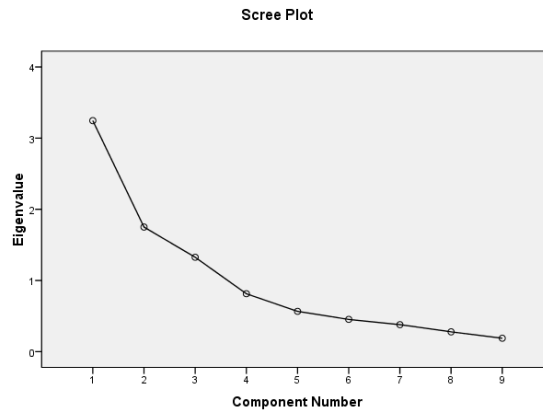
In determining reliability, we wanted to know if any items should be removed. The Item-Total Statistics showed that for all scales except Sufficiency of Originality that reliability would not be improved. Because Sufficiency of Reliability demonstrated good internal consistency at 0.76, we choose to retain item SO1. Item-Total Statistics are detailed in Table 3.

To establish the validity of these three factors, a principal component analysis took place. This analysis suggested three factors with Eigenvalues greater than 1.0 comprising a cumulative variance of 70.25%. Table 4 reports on the Total Variance explained by a three factor model.

**Table 4 - Total Variance Explained**

Factor	Initial Eigenvalue	Extraction Sums of Squared Loadings	
	Total	% of Variance	Cumulative %
1	3.25	36.07	36.07
2	1.75	19.45	55.52
3	1.33	14.74	70.25
4	0.81	9.04	79.29
5	0.57	6.29	85.58
6	0.45	5.03	90.61
7	0.38	4.21	94.82
8	0.28	3.09	97.91
9	0.19	2.09	100
Extraction Method: Principal Component Analysis.			

A visual verification of the number of factors can be seen in Figure 2. A Scree Plot indicated that three or four factors should be considered.



**Figure 2 - Scree Plot**

The principal component loadings can be seen in Table 5. No clear pattern of factors was evident from the initial solution. We decided to rotate the model to determine if an orthogonal view might clarify the factor loadings.

**Table 5 – Principal Component Loadings**

	Factor		
	1	2	3
AE1	0.47	0.57	0.28
AE2	0.50	0.61	0.37
AE3	0.47	0.59	0.07
RG1	0.75	-0.04	-0.46
RG2	0.69	-0.27	-0.51
RG3	0.73	0.16	-0.41
SO1	0.54	-0.38	0.19
SO2	0.52	-0.53	0.47
SO3	0.65	-0.42	0.46

A Varimax rotation was performed and the loadings were much improved. As can be seen in Table 6, a three factor latent structure was revealed. All loadings for *Approach to Efficiency* were greater than 0.72 and no cross loadings were significant. For *Rule Governance*, all loadings were greater than .79 with no significant cross loadings. *Sufficiency of Originality* was the exception with a low loading of 0.63; however no significant cross loadings were present. Other SO items were valid with loadings of 0.88.

**Table 6 - Varimax Rotation Loadings**

	Factors		
	1	2	3
AE1	0.79	0.08	0.08
AE2	0.86	0.02	0.12
AE3	0.72	0.23	-0.05
RG1	0.16	0.85	0.17
RG2	-0.07	0.86	0.25
RG3	0.33	0.79	0.07
SO1	0.02	0.26	0.63
SO2	0.00	0.05	0.88
SO3	0.14	0.14	0.88

## 5.1 Limitations

Looking back, our decision to retain SO1 even though reliability would have been improved by dropping it, affected this loading. The number of participants was at the lower limit to determine validity of these subscales. This may have affected SO1. Another limitation was the large number of males in the study; however previous studies have examined single gender responses (Bagozzi and Foxall, 1995) with good results.

## 6. Conclusion

Cognitive style is relevant in a wide variety of situations involving decision making, learning, and creativity. A rich, accurate and convenient measure is needed. This exploratory work extends the original seven item AI-W to nine items allowing for further validation of three subscales. These findings suggest that a three-dimensional conceptualization of the AI-W is warranted. Loadings for these factors were good and cross loadings were not significant. Adequate reliability was demonstrated for all sub-scales as well. The three factors corresponded to approach to efficiency, preference for rules governance and individual sufficiency of originality making the AI-W more useful in evaluating individual differences.

Further work should analyze additional samples and include some form of confirmatory analysis. Refinement or replacement of item SO1 is also worth further attention to increase item loading. Another possibility is the use of the AI-W to examine the role of cognitive style in prediction of technology acceptance. Researchers considering cognitive style should consider using the AI-W in the nine item, three sub-scale form.

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## Appendix A

### Workplace Problem Solving Style Questionnaire

For each pair of statements circle the number that corresponds most closely with how you think about yourself when solving problems in the workplace.

<i>Approach to Efficiency</i>																		
I am disciplined, precise, and methodical in my approach to solving problems.	1	2	3	4	5	6	7	8	9	I am creative and like to approach tasks from unusual angles.								
I can do routine work for long periods.	1	2	3	4	5	6	7	8	9	I avoid painstaking attention to detail.								
I prefer to progress incrementally towards a defined goal.	1	2	3	4	5	6	7	8	9	I cannot tolerate following routines and structure all the time.								
<i>Rule Governance</i>																		
I perform best in situations where well-established rules exist.	1	2	3	4	5	6	7	8	9	I like to tackle situations where no rules exist.								
I seek to solve problems with tried and accepted means.	1	2	3	4	5	6	7	8	9	I do not rely on accepted means to solve problems.								
I value continuity, stability, consensus, and group unity.	1	2	3	4	5	6	7	8	9	I am not always reverent of consensus, custom, and group norms.								
<i>Sufficiency of Originality</i>																		
I am more concerned with resolving problems than finding them.	1	2	3	4	5	6	7	8	9	I like to identify problems and find new avenues of solution.								
I like to produce few ideas, generally aimed at improving the existing system.	1	2	3	4	5	6	7	8	9	I like to produce numerous ideas, generally aimed at changing the existing system.								
I prefer to present few solutions which I know will be feasible.	1	2	3	4	5	6	7	8	9	I like to propose many solutions, although some may turn out to be impractical.								

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