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REVISITING KNOWLEDGE, SKILLS, AND ABILITIES NEEDED FOR DEVELOPMENT AND DELIVERY PROJECT STAFF

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Abstract

This paper is grounded on the proposition that quality and timeliness of provisioning business information system solutions can be advanced by staffing development projects with personnel based on appropriate task related Knowledge, Skills, Abilities and Personal Characteristics (KSA-P). Defining a standard repeatable process for such staffing decisions requires a consistent classification scheme for the KSA-Ps, which this paper develops through a meta-analysis of the relevant literature. A nominal group of CIOs and consulting principals provide additional support for the validity of the classification scheme. The role of general and specific experience in skill and ability development is explored. Implications and future directions of the research are discussed.

Keywords: Knowledge, skills, abilities, personal, characteristics, information, systems, personnel, assessment

Introduction

Since the inception of business information systems (IS), managers have attempted to staff development projects with personnel capable of completing their assignments on time and within budget (Hawk & Dos Santos, 1991; Jiang et al., 1999). Practitioners and researchers alike underscore the complexity and confounding facets involved in staffing decisions (Hawk & Dos Santos, 1991). Consequently this paper revisits existing literature in a meta-analysis to propose classifying knowledge, skills, abilities and personal characteristics (KSA-P).

Background: Definition of KSA-Ps

For over 3 decades the KSA term has been intertwined with the MIS literature (Cheney & Lyons, 1980; Renck et al., 1969). More recently personal characteristics have been added by (Hunter, 1994; Mayer, 2003; Teague, 1998; Turley & Bieman, 1995). The working definitions used in the paper are:

def. Knowledge refers to organized factual assertions and procedures that, if applied, makes adequate performance of a task possible (Cheney et al., 1990; Vitalari, 1985). Knowledge can be assessed through formal examination.

def. Skill refers to the proficient manual, verbal or mental manipulation of tools, techniques and methods (Cheney et al., 1990; Nelson & Winter, 1982). Skills can be readily measured by a performance test where quantity and quality of performance are tested, usually within an established time limit.

def. Ability refers to the power to perform an observable activity at the present time (Cheney et al., 1990; Renck et al., 1969). Abilities can be observed and measured through behaviors that are similar to those required in a given role. Abilities are realized aptitudes. Aptitudes are only the potential for performing a behavior.

def. Personal Characteristic refers to measures that provide insights into a person's aptitudes. Among these measures are the five factor model (Judge & Ilies, 2002), personality dimensions (Koltko-Rivera, 2004; Mayer, 2003) or structural model (Mayer, 2003). These measures and others should be examined to determine if there is potential to identify the personality traits identified as necessary for expert skill acquisition.

Initial Meta Analysis of Existing Literature

The authors conducted a review of the existing information system human resource, project staffing and educational curriculum literature in an attempt integrate the existing IS KSA-P models. From this literature review, archetype papers were selected to seed the initial analysis. A summarization of the selected papers and their contribution to the classification of specific KSA-Ps is given below.

Table 1. KSA-Ps Meta Analysis

Reference	Knowledge	Skills
Turley & Bieman, (1995)		
Vitalari & Dickson, (1983)	<ul style="list-style-type: none"> • Employing previous knowledge • Operative knowledge for application of heuristic knowledge 	
Jiang et al., (1999)	<ul style="list-style-type: none"> • Technical knowledge • Business knowledge 	<ul style="list-style-type: none"> • Communication skills • Political skills
Schenk et al., (1998)	Domain specific knowledge <ul style="list-style-type: none"> • Semantic knowledge (generic facts) • Episodic knowledge (experience) 	
Alshawi et al., (2003)	<ul style="list-style-type: none"> • Business knowledge • Domain knowledge • Technical knowledge 	<ul style="list-style-type: none"> • Political skills • Interpersonal skills • Communication skills
Hunter, (1994)	<ul style="list-style-type: none"> • Knowledge of the user's functional area (domain knowledge) • Technical knowledge • Knowledge of people 	<ul style="list-style-type: none"> • Interpersonal Skills • Communications skills • Interviewing skills • Problem solving skills • Organization skills
Misic & Graf, (2004)		<ul style="list-style-type: none"> • Analytical skills (critically decompose and examine things) • Technical skills (Employ techniques) • Communication skills (Write and speak & communicate clearly) • Interpersonal skills (Interact with others)

Table 1. KSA-Ps Meta Analysis (continued)

Reference	Abilities	Personal Characteristics
Turley & Bieman, (1995)	<ul style="list-style-type: none"> They are proactive with management 	<ul style="list-style-type: none"> They are externally focused on people or objects outside the individual They maintain a “big picture” viewpoint They have a bias for action They possess a strong sense of mission They exhibit and articulate strong convictions They help other engineers
Vitalari & Dickson, (1983)	<ul style="list-style-type: none"> Problem structuring 	<ul style="list-style-type: none"> Flexibility Analogical reasoning Setting high but measurable goals Hypothetical deductive process to discard low probability hypotheses and retain high probability hypotheses. Understanding of and allocating time for interpersonal relationships with users importance of character
Jiang et al., (1999)	<ul style="list-style-type: none"> Communication skills Political skills 	<ul style="list-style-type: none"> Interpersonal
Schenk et al., (1998)	<ul style="list-style-type: none"> Strong procedural methods based on real world episodes Adept at politics and conflict resolution Goal setting Communicate with technical and non-technical audiences Uses heuristics to identify potential solutions 	<ul style="list-style-type: none"> Identify cues among many extraneous facts Hypothesis management (testing and discarding) Trigger identification (filter, process and analyze environmental information)
Alshawi et al., (2003)	<ul style="list-style-type: none"> Understanding of stakeholder interests 	
Hunter, (1994)	<ul style="list-style-type: none"> Packaged software analysis Database management systems Personnel management 	<ul style="list-style-type: none"> Conceptual thinking ability (based on personality traits) Concern about user involvement Concern about managerial prerogatives Concern about organizational politics Generalist’s skills (over specialist skills)
Misic & Graf (2004)		

Refining the KSA-Ps

In an attempt to further refine the KSA-Ps, a nominal group was formed consisting of 20 chief information officers within the Fortune 500 and consulting principals that support the Fortune 500. The group included representatives from 10 southeastern and mid-western states. The group initially physically met to discuss both the KSA-P research findings and to provide industry practices. Discussions focused on KSA-Ps of project teams engaged in systems development (primarily in the phases of analysis, design, construction, testing, and deployment). Four virtual-meeting rounds were then facilitated by the authors. The clustering of responses indicated that the nominal group clustered KSA-Ps into business domain, project management, SDLC process, and social-political. Specifically, they defined relevant KSA-Ps dealing with the:

- application of technology
- interpersonal oral and written communication
- problem solving
- business process and execution
- working at multiple levels of abstraction
- working with others

- adapting to change and being a change agent
- career-long learning
- developing credibility and marketing themselves and their work products
- ethical values and behavior
- a *can-do* work ethic

The nominal group members also provided insight into the relationship of KSAs in practice and why research in the area may have conflicting interpretations. Without exception, group members indicated that many tasks performed by their staff members combine structured knowledge, explicit skill, and demonstrated ability to perform. One often cited example is that of a programmer, who must have specific knowledge of programming patterns for specific architectural standards (example: asp.net thin client), applying programming syntactical skills (example: vb.net), and using the cognitive abilities (example: to transform specifications to code). The group members also supported the explicit separation of personal characteristics from the traditional KSAs.

Extending the KSA-Ps Notion Based on Experience

The nominal group results indicate the inter-relationship of KSAs. Learning theory research concludes that skill acquisition is gained through experience based on a level of existing knowledge or aptitude (Scandura, 2001, Dreyfus & Dreyfus, 2005). Consequently a new perspective for KSA-Ps is proposed. This perspective explicitly presumes foundation knowledge or individual's aptitudes as preconditions to experience, and that experience can be further divided into generalized and specific categories. Within this perspective, experience is defined to be demonstrated abilities and skills rather than parameters related to the mere passage of time.

Foundation Knowledge and Aptitude

Foundation knowledge and aptitudes includes formal knowledge such as technical knowledge and an individual's innate capacity, such as a cognitive and problem solving capability.

Generalized Experience

Generalized experience captures the type of multi-context experience that builds upon the foundation and brings a higher level of ability to the skill. For technical knowledge, generalized experience may be measured by the years of experience working in a particular field to build one's ability or skill. The same is true for aptitudes like personality traits, as experiences across multiple contexts also help to inform and mature natural aptitudes.

Specific Experience

Specific experience captures the experience that one gains by working in a particular organization, working with a particular technology, or in the case of personality traits, working with a group of people for an extended period.

Instantiating the Knowledge, Aptitude and Experience

Table 2 depicts the mapping of knowledge and aptitudes across the categories of generalized and specific experiences.

Table 2. Example Mapping of Knowledge and Aptitude with Demonstrated Skills and Abilities

Baseline Knowledge and Aptitude	Demonstrated Skills and Abilities through	
	Generalized Experience	Specific Experience
Application of technology Knowledge of application architecture	Ability to generalize from platform and architecture to another	Developing and delivering on specific platforms and architectures
Interpersonal oral and written communication Outgoing and communicative Knowledge of people	Ability to motivate or persuade others Ability to understand group motivations	Convincing or persuading another person to accept an idea Ability to understand another person's motivations
Problem solving Aptitude for conceptual thinking Analytical aptitude or training	High level project planning Critically decompose and examine a project for cause and effects	Problem solving during a crisis Critically decompose and examine a task
Business process and execution Knowledge of business theory or practice	Managing a business unit	Designing and implementing a new business unit
Working at multiple levels of abstraction Training in SDLC	Managing a systems development team	Managing a systems development life cycle
Working with others Sensitivity to others' needs	Organizational citizenship behavior	Mentoring another person
Adapting to change and being a change agent Welcoming change for the potential to make things better	Quickly adapting to new processes or systems	Campaigning for adoption and acceptance of a new system
Career-long learning Pursuit of knowledge	Pursuit of additional training	Taking a specific training class
Developing credibility Knowledge/aptitude to Market products and services	Learning to sell yourself and what you can deliver	Selling the functionality of the system
Ethical values and behavior A strong sense of right and wrong	Properly handling sensitive corporate materials	Keeping a confidential piece of information safe
A can-do work ethic Has a bias for action Has a strong sense of mission	Working through obstacles Seeks closure, doesn't allow multiple activities stop completion	Learning not to wait for resources such as waiting for a client to respond Whatever it takes to "go-live"

Implications of incorporating experience into the KSA-P model

In the table above, the KSA-Ps defined as relevant by the nominal group of corporate CIOs and consulting principals are used to provide example instantiations of skills and abilities resulting from generalized and specific experiences. These extensions to generalized or specific experiences that project staff might encounter are not meant to be a full enumeration. Rather the extension provides examples of activities that the staff has the knowledge or aptitude to perform. Likewise, if a staff member possesses a particular aptitude or knowledge, the list provides guidance to the IS organization of ways to extend that knowledge or aptitude into observable skills and abilities, through exposure to generalized and specific experiences.

Conclusion

Meta-analysis of the KSA-P literature used to seed Table 1 provides evidence that the IS literature supports all four dimensions (knowledge, skills, abilities, and personal characteristics) of this classification scheme. The clustering of the responses from the nominal group of CIOs into the same four dimensions provides additional evidence of the validity of the classification scheme. This research also supports the recent IS KSA literature that includes personal characteristics as a separate component of the KSAs. Further implications of this research support the proposition that generalized and specific experiences can extend baseline knowledge and aptitude into observable skills and abilities.

Though it is beyond the scope of this paper, the theoretical basis for incorporating experience into the KSA-P model is explored. More specifically, future research will explore whether organizations that recognize personal characteristics, balance formal education, and manage their staff's experiences succeed in obtaining better and sustained performance from their staff. That is, future research will address the question: does staff performance and career development improve when IS staff members are exposed to an individualized experiential track as they move from project to project? Further research will also explore specific roles within the IS development and project delivery processes to identify and cluster specific knowledge and aptitudes with the generalized and specific experiences that develop desirable skills and abilities.

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