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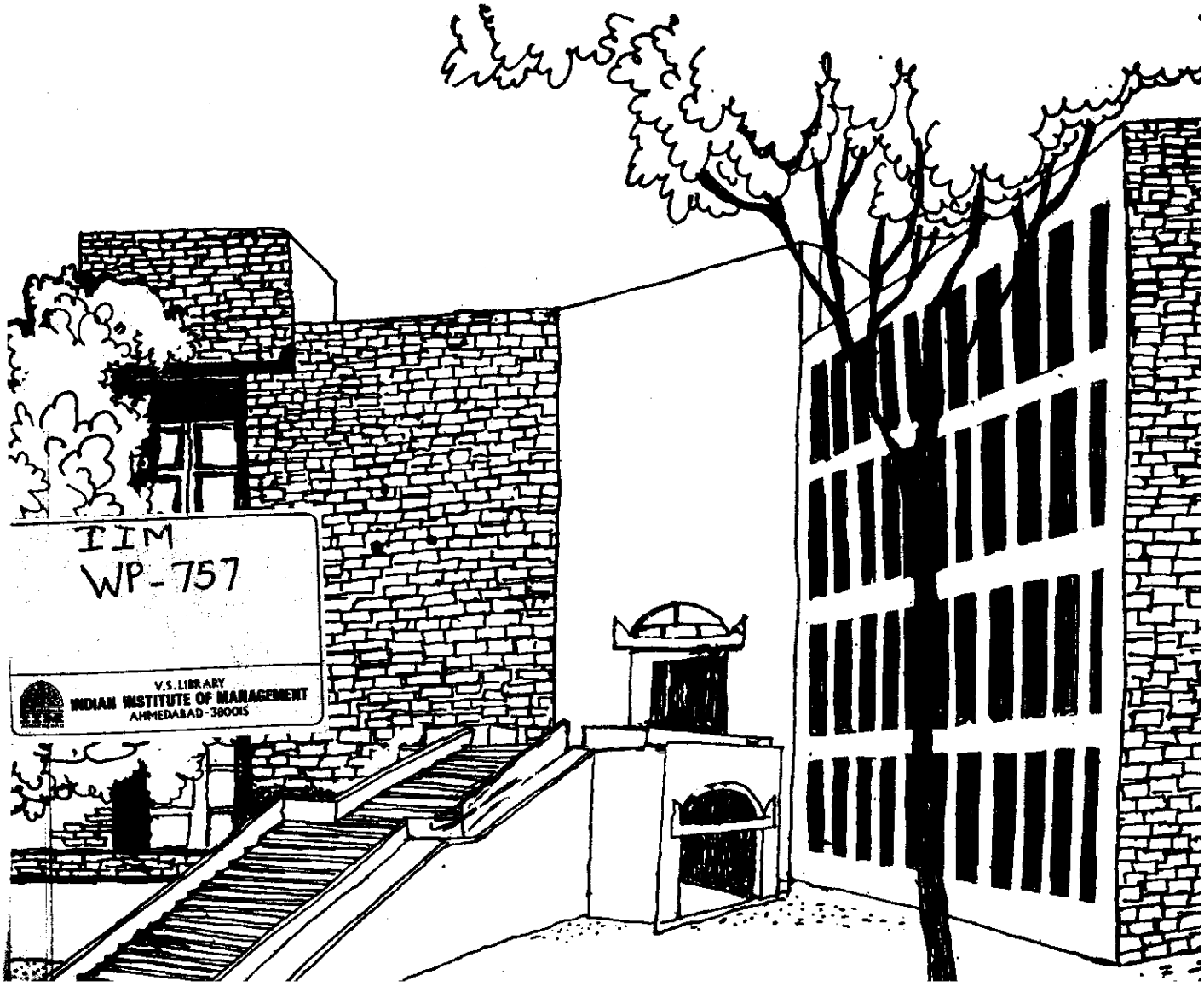

ATTITUDE TOWARD COMPUTERS: DEVELOPMENT OF A SCALE

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Running head: Attitude toward computers

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Attitude toward computers: Development of a scale

ABSTRACT

This study reports the development of an instrument to measure attitude toward computers. The importance of attitude in attaining the full potential of computerization is highlighted and possible uses for the attitude toward computers (ATC) scale are suggested.

Attitude toward computers : Development of a scale

Perhaps the most visible manifestation of the information revolution is the computer. Computerization has either changed or has displayed the potential to change the work place almost all over the world. It has emerged as a major technological as well as social movement in both developed and developing countries. No area of human endeavour -- business, industry, education, health, entertainment -- has remained untouched by computerization. The inevitability of computerization is underscored by the fact that by 1987, the number of computers (including personal computers) installed in India was estimated to be between 50,000 and 100,000 (Bhatnagar and Ramani, in press). An earlier estimate put the number of digital computers in use in the United States at "well over 200,000" (Kling, 1980). In 1981 alone, organizations in the U.S. bought one million data terminals worth $2.6 billion, and this was expected to grow constantly in the coming decade (Zuboff, 1982).

Technological developments, particularly those which affect important areas of a person's life such as work or job, can evoke diverse reactions from people. According to Beatz (1985), people can respond to new technology in one of the following three ways:

i) some will reject its introduction and may say, for example, "Wait until new generation of equipments appear"

ii) others will put the decision on hold while managers become computer literate, and

iii) still others will accept the optimism of advisors and view problematic horror stories the way smokers view cancer statistics, that is, "it can't happen here".

Zuboff (1982), on the other hand, identifies three categories in which people can be grouped on the basis of their reactions to technology: those who bemoan new developments, those who applaud new forms of technology, and those who consider technology to be neutral. Disagreeing with the "neutral technology" view, she suggests three areas of concern resulting from the usage of new information systems:

i) quality of the employment relationship,

ii) attitudes toward managerial control, and

iii) basic beliefs about the nature of an organization and the role of management.

Successful installation and adaptation of computerization requires development of new infrastructure which involves huge investments for acquiring equipment, design of the physical space and furnishings, and training people for the new workplace (Beatz, 1985; Scacchi, 1987). For any new technology, people must learn to be comfortable in using the equipment, they must understand its long term impact on economic and social structure, and organizations must develop people who can use and maintain the system (Beatz, 1985).

In spite of such realization, it is, indeed, surprising that "remarkably few studies actually evaluate the use and social consequences of systems in place" (Kling, 1980, p.89). This may be due to a set of basic assumptions which take people's acceptance of new technology for granted. Computerization seems to have created a new culture of generally shared beliefs such as "anyone can use the computer", "everyone can benefit from computer", "the more power computer, the better" (Sproull, Keisler, & Zumbro, 1984). Developing infrastructure and making investments without paying adequate attention to the social consequences create "conditions under which even the best technically designed system will be less than useful" (Kling, 1980, p.89).

It can be argued that computerization supports either flexible offices or regimented offices. Computerization can also be considered to simplify office work, reduce drudgery, and make clerical work more flexible. Personal computers have also tended to provide some glamour to clerical work. Carter (1984) reported functional differentiation and creation of new positions such as operators, programmers, analysts, and functional specialization in terms of skills and expertise as a result of computerization. She also observed dispersion of personnel across functional areas, replacement of departments and groups, as well as substantial reduction of lower positions. Computerization, ultimately, may to lead to a two-tier work

force--one elite and skilled professionals and the other doing unavoidable menial jobs, and very flat organization structures (Harris, 1985). Managing such organizations will be challenging and will call for innovative ways of dealing with unprecedented situations.

Quality of worklife and performance form two crucial outcomes of computerization. Personal computers have been perceived as being quite helpful in improving quality of work life and work effectiveness (Gattiker, Gutek, and Berger, 1985). While people actually enjoy working on computers, it can have serious negative physiological and psychological consequences. It has created new hazards such as eye strain, back pain, and mental load due to long hours with computers (McGlothlin, 1984). While physical conditions at work have improved and operators do not complain of overload of work, computerization has resulted in increased psychological strain on people. Stress associated with visual display units has resulted in restricted number of hours permitted on terminals, and an increase in duration of rest breaks (International Labour Organization, 1984). Often managers consider computer work to be boring and tiring because a major part of the work is perceived to involve inputting numeric data. This has also created a tendency to delegate computer oriented work to support staff and to complain that maintaining proficiency on office computers takes more time than they would like it to. Also, at times fairly high levels of frustration

have been observed among managers who use office computers ("Many executives," 1985).

Some other critical issues related to computerization are responsibility, power, and control. One view is that technological change will increase worker's responsibility on the job resulting in better control over one's job. The opposite view holds that computerization has segmented the tasks and has created more routine and repetitive jobs. Design of equipment tends to dictate the pattern of work which has resulted in loss of responsibility and control over jobs (Carter, 1984; International Labour Organization, 1984).

Introduction of computing techology has led to redistribution of power among different functional areas and specializations (Bhatnagar, 1986; Carter, 1984). Some studies have attempted to examine altering power relations among key participants in American municipal governments as a result of automated information systems. In general, it was found that computer-based systems often served as "political, power-reinforcing instruments... (and) should be viewed as social resources that are absorbed into ongoing organizational games but do not materially influence the structure of the games being played" (Kling, 1980, p.92). While computerized systems have helped to achieve goals of efficiency and effectiveness, they have also enabled the management to exercise more control (Gattiker et al.,

1986). Kling and Iacono (1984) have also observed that computerization tightens control and discipline.

Two of the more important effects of computers in organizations are on people and on their jobs. After interviewing approximately 200 employees, supervisors, professionals, and managers from banking, retail, and consumer goods organizations in three countries, Zuboff (1982) reported deskilling and elimination of discretion from job. One of the principal themes which emerged from her study was that computer changes the individual's relationship with the task. Computer mediates between the task and the individual, thus making work abstract. Mowshowitz (1976) concluded that computers fragmented tasks, routinized work, promoted centralization of power and control, created loss of individual responsibility, and had a dehumanizing effect. Apprehensions about the risk of return to Taylorism and monotonous form of more tedious and repetitive tasks have also been expressed. New technologies raise skill requirements creating the need for a more highly skilled and versatile workforce and possible displacement of low skilled workers (International Labour Organization, 1984).

In addition, computers have affected interpersonal interaction negatively and have led to social isolation (Beatz, 1985; Kling and Iacono, 1984; Zuboff, 1982). Computers may isolate and eliminate from jobs older people who may find it difficult to adapt; may increase inequities between rich and poor; may introduce discriminatory barriers based on intellectual capacity

and education (Abelson, 1984). Computerization may also generate new social divisions based on knowledge of computing and role of computing in the organization (Sproull, Keisler, and Zubrow, 1984).

Most of the problems related to use of technology come from people resisting it and sabotaging its introduction (Beatz, 1985). Due to such resistance office automation has not grown as rapidly as originally predicted ("Many executives", 1985). While change is imperative, people resist change for several reasons such as insecurity, threat to status, economic considerations, cultural and emotional values, lack of trust, low tolerance for ambiguity and several other social psychological dimensions.At times fears of under and inadequate utilization of computers have been expressed (Mukhopadhyaya, 1980). Beatz (1985) found that inadequate planning for human resources impact of change led to dissatisfaction and reduced results of new technology. Employees had developed ways to frustrate the data gathering method used to compute the productivity score. Some of the common forms of sabotage observed were deliberate entry of incorrect information, and passive resistance such as slowing down to foil the implementation.

Given such widespread positive and negative social and psychological effects of computerization, understanding how people perceive computing technology, and what kinds of attitudes and beliefs are held by organizational members, would be a crucial dimension for successful acquisition and implementation

of new technology (Beatz, 1985; Gattiker et al., 1985). People's perceptions can influence their interpretations of events and their reactions to them (Bem, 1978; Weick, 1979). Differences in perceptions may lead to problems of conflict and coordination which in turn may affect productivity and profitability (Gattiker et al., 1985; Gold, Rosegger and Boylan, 1980). It is crucial for the management to understand how employees evaluate the new technology if objectives of productivity and effectiveness have to be achieved (Gattiker, 1984). If they look upon it favorably, they will tend to accept it easily and will even make adjustments to suit its requirements and proper implementation. If, however, they do not look upon it favourably, then utilizing the technology to its full potential will become extremely difficult, if not impossible.

Attitudes have long been known to contribute to the understanding of an individual's response and reaction to a stimulus or situation (Maier and Verser, 1982). The stability and consistency of attitudes in the organizational setting have also been demonstrated in a five-year longitudinal study by Staw and Ross (1985). Harris (1985) has argued for the need for a change in attitudes to effectively meet the shift to electronic and automated equipment at work. While very little empirical research has been done concerning attitudes toward computerization (Kling and Iacono, 1984), "the relative neglect of user attitudes in the study of office information technology

could be detrimental to (the) goals... of facilitating higher productivity and job satisfaction" (Gattiker et al., 1986).

Even though computers are fast becoming almost ubiquitous, the full potential of computerization is yet to be realized. Lack of attention to attitude toward computers appears to be one of the significant reasons for their inadequate utilization. A clear need, therefore, exists for a standardized measure to develop a better understanding of such attitudes. This paper reports the development of such an instrument.

METHOD

A pool of items was generated after referring to a variety of sources. Some of the items were adapted from Gattiker et al. (1985). This pool of items was discussed with a group of managers and with some computer professionals specializing in software development and implementation of computerization projects. Based on these discussions, 50 items were retained for further analysis.

As a pilot study, an instrument containing these 50 items was administered to 53 participants of a management development programme for middle level managers with five or more years of work experience, working with medium to large organizations in public and private sectors. Respondents were asked to mark their personal opinion concerning the 50 statements on a seven-point

scale ranging from 1 for "strongly disagree" to 7 for "strongly agree" with the midpoint of 4 representing "neither disagree nor agree". Twenty-five statements were negatively worded to reflect an unfavourable attitude toward computers and were reverse scored. For the purpose of analysis, the 50 items were grouped into four apriori categories: work effectiveness - 15 items, quality of work life - 11 items, control - 9 items, and general - 15 items. On the basis of item analysis and computation of reliability following Winer (1971), 45 items were retained for further analysis.

The 45-item version of the instrument was administered to 190 participants of various management development programmes held at a leading institute of management in the country.

A principal components analysis with varimax rotation was performed on the 190 responses of the 45-item instrument. The initial analysis indicated a 14-factor solution. After deleting the items which did not have loadings of 0.30 or higher on any of the factors (Nunnally, 1978), 23 items were retained for further analysis. A principal components analysis with varimax rotation was performed on the 23 retained items. Only those items were included which loaded at least 0.50 on a factor (Nunnally, 1978). Estimates of reliability for each of the seven subscales and also for the entire instrument consisting of all the 23 items were computed. The factor structure of the seven subscales was also examined individually to check their dimensionality.

RESULTS

A biographical profile of the respondents is provided in Table 1.

Table 1 about here

As many as 158 (83.16%) of the respondents were male, making the sample overwhelmingly male dominated. While the average age of the sample was around 42 years, the 36 to 50 years age group accounted for almost two-third of the sample. Expanding the age group to 31 to 55 years covered almost the entire sample (92.64%). On similar lines, the work experience range of 6 to 30 years covered the bulk of the respondents (88.42%) while the 11 to 25 years range accounted for about two-third of the sample. Bulk of the respondents had master's degree or above while almost all the rest had education upto the bachelor's level. Private sector and government organizations covered about a third of the sample each whereas about one-fourth of the respondents were employed in public sector organizations. Among the functional areas, the highest number of executives were working in administration, followed by finance/accounts, personnel, and marketing/sales in that order. About half of the respondents belonged to senior levels of management of their organizations and about one-third were middle level managers. Top managers were around 10 percent. Hardly any of the participants (5.8%) had actually used software and worked with personal computers though quite a few (36.8%) were hopeful that

they could do so with just a little help. In general, computer awareness was low.

Results of the 7-factor solution of the principal components analysis of 23 items with varimax rotation are in Table 2

Table 2 about here

The first factor contained seven items mostly referring to how, as a result of computerisation, working would become easier, more enjoyable, and so on. It was, thus, labelled "work facilitation". It also accounted for the highest percentage of variance out of all the seven factors. The second factor, consisting of three items, was labelled "effect on people" as it referred to possible retrenchment and reduced interaction as a result of computerisation. Factor 3 referred to what might have to be done before computers can actually be used and was, therefore, called "preparatory action". The next factor--called "effect on autonomy" -- contained items referring to control of people's behaviour at work and taking away their freedom. The fifth factor contained three statements concerning the quality of data provided by computer and the effect of computerization on the speed and thoroughness of work and was, thus, called "quality of output." The next factor combined three broad statements about the overall effect of computerisation and was labelled "general effectiveness". The last factor referred to the variety

and challenge in jobs and to tasks at work. It was, therefore, labelled "nature of work".

It could, thus, be said that the 23-items instrument contained seven subscales corresponding to the seven factors.[1] The variance accounted for by the first component ranged from 75.76% for the Nature of Work subscale (Factor 7) to 49.38% for the General Effectiveness subscale (Factor 6) as indicated in Table 3. A one component solution seemed adequate for each of the seven subscales. The subscales are, thus, acceptably unidimensional.

Table 3 about here

Reliability estimates for each of the seven subscales are also indicated in Table 3. These ranged from 0.825 to 0.441. The estimate of reliability for the complete instrument with all the 23 items was 0.86.

The scores on the seven subscales were correlated. The correlation coefficients are in Table 4. It can be seen that the correlation coefficients of Work Facilitation (Factor 1), Quality of Output (Factor 5), and Nature of Work (Factor 7) with one another are the highest with the exception of their relationships with General Effectiveness (Factor 6). Similarly, the relationship between effect on People (Factor 2) and Effect on

Autonomy (Factor 4) is the strongest as compared to the relationship of these two with all the other subscales. As could be expected, the general effectivness subscale is significantly correlated with all the other subscales. These relationships tentatively indicate that there may be two sets of subscales, one work-related, consisting of work facilitation, quality of output, and nature of work; and the other people-related consisting of effect on people and effect on autonomy.

Table 4 about here

DISCUSSION

The development of an instrument to measure attitude toward computers (ATC) has been reported in this paper. The results reveal that the 20-item instrument taps attitude toward computers with seven factors. The full ATC scale and its seven subscales demonstrated satisfactory internal consistency and factorial stability.

The investments of time, effort, and money being made in computerization can yield better returns through the use of the ATC. The instrument is likely to be useful in a wide variety of organizational settings. Organizations planning to go in for computerization can use the ATC to discover areas in which unfavourable attitudes exist which may hamper implementation of computerization projects. These areas can then be targetted for

appropriate unfreezing programmes to alter attitudes as a part of the preparatory action for computerization. On the other end of the continuum, organizations that have already gone in for computerization and are facing problems in implementation and full utilization despite taking care of all technological and system development aspects, may find the ATC useful for identifying attitudinal obstacles and getting some clues and directions for corrective action.

In summary, the ATC can serve as a useful dignostic aid in organizational efforts to achieve the full potential of computers. This instrument is also likely to facilitate further empirical work in certain areas of organizational functioning which are affected by computerization but in which such research has been hampered due to lack of a standardized measure. Hopefully, future use of the ATC will result in more efficient and willing use of computers leading to greater organizational effectiveness.

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TABLE 1

Sample Profile

Age	Number	Percent
($\bar{X}$=41.98, S.D.=7.26)		
Upto 25 years	2	1.05
26 - 30	6	3.16
31 - 35	32	16.84
36 - 40	42	22.11
41 - 45	42	22.11
46 - 50	38	20.00
51 - 55	22	11.58
Above 55 years	4	2.11
Work Experience		
($\bar{X}$=19.30, S.D. = 7.36)		
Upto 5 years	7	3.68
6 - 10	16	8.42
11 - 15	36	18.95
16 - 20	40	21.05
21 - 25	44	23.16
26 - 30	32	16.84
Above 30 years	10	5.26

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TABLE 1 (Continued)

Educational level	Number	Percent
Bachelor's Degree	75	39.47
Master's Degree or above	112	58.95
Kind of Organization		
Private Sector	70	36.84
Public Sector	47	24.74
Government	63	33.16
Others	8	4.21
Functional Area		
Finance/Accounts	28	14.74
Marketing/Sales	20	10.53
Personnel	25	13.16
Production	12	6.32
Engineering	15	7.89
Administration	40	21.05
Electronic Data Processing	2	1.05
Others	35	18.42

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TABLE 1 (Continued)

Level in the Organization	Number	Percent
Top Management	24	12.63
Senior Management	96	50.53
Middle Management	66	34.74
Junior Management	3	1.58
Computer Awareness		
Can carry on intelligent conversation about computers	29	15.26
Familiar with hardware, software, and computer capabilities	29	15.26
Can work with PC with little help	70	36.84
Have used spreadsheet or other PC software	11	5.79
Familiar with programming languages and system design	25	13.16

TABLE 2

Results of Principal Components Analysis

FACTOR 1		FACTOR 2		FACTOR 3	
Work Facilitation		Effett on People		Preparatory Action	
Item	Loading	Item	Loading	Item	Loading
1	0.582	14	0.635	21	0.874
2	0.728	18	0.800	23	0.630
3	0.774	20	0.691		
4	0.635				
10	0.788				
19	0.611				
22	0.648				
Eigen value: 4.196		Eigen Value: 1.935		Eigen Value: 1.638	
Var Acctd for:18.243%		Var Acctd for:8.413%		Var Acctd for:7.122%	

....Continued on next page

TABLE 2 (Continued)

FACTOR 4

Effect on Autonomy

Item	Loading
8	0.515
9	0.621
17	0.695

Eigen Value: 1.515
Var Acctd for:6.589%

FACTOR 5

Quality of Output

Item	Loading
11	0.504
15	0.723
16	0.70

Eigen Value: 1.628
Var Acctd for:7.077%

FACTOR 6

General Effectiveness

Item	Loading
5	0.644
6	0.631
13	0.626

Eigen Value: 1.664
Var Acctd for:7.234%

FACTOR 7

Nature of work

Item	Loading
7	0.704
12	0.826

Eigen Value: 1.766
Var Acctd for: 7.678%

TABLE 3

Subscale Characteristics

Subscale	Percent Variance Explained by First Component	Reliability Estimate
1	54.224	0.825
2	56.232	0.660
3	69.874	0.691
4	49.575	0.550
5	49.376	0.658
6	57.764	0.441
7	75.116	0.664

TABLE 4

CORRELATIONS AMONG FACTORS

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTO
ACTOR 1 Work acili- tion)							
ACTOR 2 Effect n people)	0.079						
ACTOR 3 repara- ory Ac- ion)	0.371***	0.072					
ACTOR 4 Effect n Auto- omy)	0.169*	0.470***	0.124				
ACTOR 5 Quality f Output)	0.527***	0.129	0.220**	0.220**			
ACTOR 6 General ffecti- eness)	0.532***	0.181*	0.369***	0.209**	0.422***		
ACTOR 7 ature Work)	0.632***	0.116	0.352***	0.236***	0.373***	0.420***	

* p< 0.01
** p< 0.005
*** p< 0.0005

Footnote

1 Complete instrument is available on request from the first author.