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Investigating the Gap Between IT Professionals and Users

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Abstract

Fundamental differences exist in the views of technology held by IT professionals and users, creating a gap between the two groups. This gap creates obstacles in information system design and development through communication difficulties and misunderstandings. In order to explore this, a Gap Model has been developed to examine the nature of the differences and the relationship between these differences and technology acceptance and information system success. This paper presents the Gap Model and preliminary findings from an initial set of interviews.

Keywords

Human Computer Interaction, User Characteristics, IS Success, Technology Acceptance

INTRODUCTION

In general discussion both academics and IT industry representatives can be heard discussing the differences between IT professionals and users. These differences have been described in terms of background differences (Cavaye 1995), cognitive differences (Smith 1997), a lack of knowledge of IT on the part of users (Igbaria 1993), or communication difficulties (Mayhew 1992). While research has been conducted into user characteristics, little has been done to examine the differences between users and IT professionals. This paper seeks to address this by presenting a set of factors organised into a framework for examining the gap between IT professionals and users in order to identify where similarities and differences exist. This framework also seeks to explore the possible relationship between the gap and information technology acceptance and success.

Much has been said of the difficulties that exist with user acceptance of computer systems (Ives and Olson 1984, Butler and Fitzgerald 1997, Zhang et al 2004) and of the failure rate for system development (Oz 1994, Legris et al 2003). Work has been done in the area of user centred design and improving information system usability, and yet difficulties remain with successful information system development. The fundamental problem underlying information system development success and failure may be related to the basic technological view held by IT professionals and information system users. IT professionals and users are not operating from a common point of reference and are not speaking the same language (Mayhew 1992, Grudin 1993).

Stair and Reynolds (2003) discuss the reluctance of users to work with "computer people" as a problem in information system development. The fundamental differences in technological views between IT professionals and users may lead to communication difficulties and misunderstandings or antagonism. Difficulties in creating information systems that address the needs of the user and in eliciting information system requirements would be encountered through this lack of understanding. Each group may have different attitudes towards change, different expectations, different languages, and different views of what technology can achieve, how it can be used, and its level of difficulty and desirability. These differences will be explored to see if there is a 'gap' in the views of technology held by IT professionals and users. An understanding of such a gap may assist in the development of information systems that suit the current needs of organisations and society.

For the purpose of this research, IT professionals are defined as individuals involved in information system development who are directly involved in the information technology industry, whether they are developers, designers, business analysts, or technical personnel. Users are defined as the actual operators of an information system, regardless of position or status (Robson, 1997, Bevan, 1997). For the purpose of this study this grouping is confined to those users who are not directly involved in the information technology industry.

This work stems from a current and ongoing research project investigating the differences between IT professionals and users in terms of their approach and attitude towards technology. A framework for investigating the potential differences has been developed based on a review of available literature from a range of research areas. This Gap model presents a set of factors sorted into three groups. Interviews with IT

professionals and users will be analysed to determine which of these factors exhibits different conditions for each grouping. The model will then be refined based on which factors show variance and which do not. The model could then be used to identify potential areas of difficulty within information systems development that may impact of the success of the development and the acceptance of the technology.

The first section of this paper will present the research approach used in this work and describe the case study site that has been used in preliminary research. The second section will describe the Gap Model detailing the factors and characteristics that have been identified from a review of literature. The third section will present the preliminary findings from early interviews within the case study site. Primary differences between IT professionals and users will be identified, and differences within the two groups will be described. Early findings concerning the success of the information system development will be presented.

RESEARCH APPROACH

The research conducted in this work has followed the guidelines suggested by Miles and Huberman (1984) for qualitative research and has consisted of a review of literature, development of a conceptual model, preliminary interviews, case study work, and data analysis using the conceptual model. The research question is dependant on different environments and is concerned with social interpretation and understanding human work and human activity, characteristics described by Nurminen (1997) as belonging to the interpretive research paradigm. The very nature of attempting to represent the ideas and perceptions of an individual is an interpretive act, and generalisation across a variety of individuals and organisations is problematic. Attempting to model those ideas and perceptions may alter the participants' views as they endeavour to structure their thoughts.

A review of available literature has been undertaken to identify the nature of the gap between IT professionals and users. There does not appear to be a coherent research direction concerned with this field and factors described as differentiating IT professionals and users were identified from the areas of user acceptance, innovation diffusion, human factors and mental models. These factors will potentially describe the nature of the gap that appears to exist between IT professionals and users, with specific attributes for each of the factors belonging to each group. The list of factors was sorted into the major groupings of general factors, IT specific factors, and mental model factors. A conceptual model was then developed resulting in the Gap Model.

An investigation of users and developers from both unrelated situations and within a case study organisation has been undertaken. Case studies are idiographic methods that allow the exploration of individuals in unique situations. I have used idiographic methods as these place emphasis on the background and history of the subject under investigation (Burrell and Morgan 1979). The Gap Model was applied to the information gathered from these interviews to determine the importance and relevance of the factors in relation to the gap between IT professionals and users. Early investigations have found a variance in the degree of importance of different factors and the model continues to be refined as further research is undertaken.

Case Study Description

Case study research has been undertaken with a set of preliminary interviews and an examination of a specific information systems development project. The interviews were semi-structured, with a set of open questions addressing each factor in the Gap model used as a guide for the interviews. All interviews were recorded and transcribed. The initial set of interviews involved four unrelated IT professionals and four unrelated users.

The second set of interviews took place within a case study organisation with a group of IT professionals and users involved in the development of an internet application. All individuals involved in the development project at the time of access were interviewed, including development staff, analyst staff, management and user representatives. Access to the case study site was delayed pending the resolution of a specific conflict that centred on one of the IT professionals. Information relating to this conflict was obtained from other participants, however had access been granted earlier more insightful information may have been obtained. Another key user left the project during the delay, and this hindered access to information. An opportunity to observe interaction between users and IT professionals during the testing phase of the project was initially promised, however it did not eventuate. Documentation relating to the project was provided for examination.

The interview process allowed the exploration of the personal attributes of the participants, and it is this personal view that is vital in determining how an individual feels about technology. However, the information gathered is limited by the self-reported nature of interview process. The opportunity to observe an individual directly interacting both with technology and with representatives of either the IT professional or user groups would assist in overcoming this limitation.

The next section will describe the Gap model, detailing the sources of the different factors identified as relevant for examining the differences between IT professionals and users.

DESCRIPTION OF THE 'GAP MODEL'

The relationship between the characteristics of an individual and their interaction with information technology is acknowledged in literature. Smith (1997) discusses user characteristics in terms of a range of attributes including physiology and psychology. He acknowledges that individual characteristics will determine the perceptions and attitudes individuals form of new technologies, and that this in turn will influence their behaviour. Cavaye (1995) describes how different user-developer backgrounds and divergent "world views" can impact on the relationship between users and analysts. Rogers (1995) presents a classification of technology adopters according to five categories: innovators, early adopters, early majority, late majority, and laggards, with specific characteristics for each category. These and other characteristics derived from literature from a range of areas including user acceptance, innovation diffusion, human factors and mental models provided a list of factors appropriate for the exploration of the differences between IT professionals and users. These initial factors were compared for an overlap of concepts and grouped according to similar principles into three primary groups: general, IT specific, and mental model factors. This grouping formed the basis of the Gap Model shown in Figure 1.

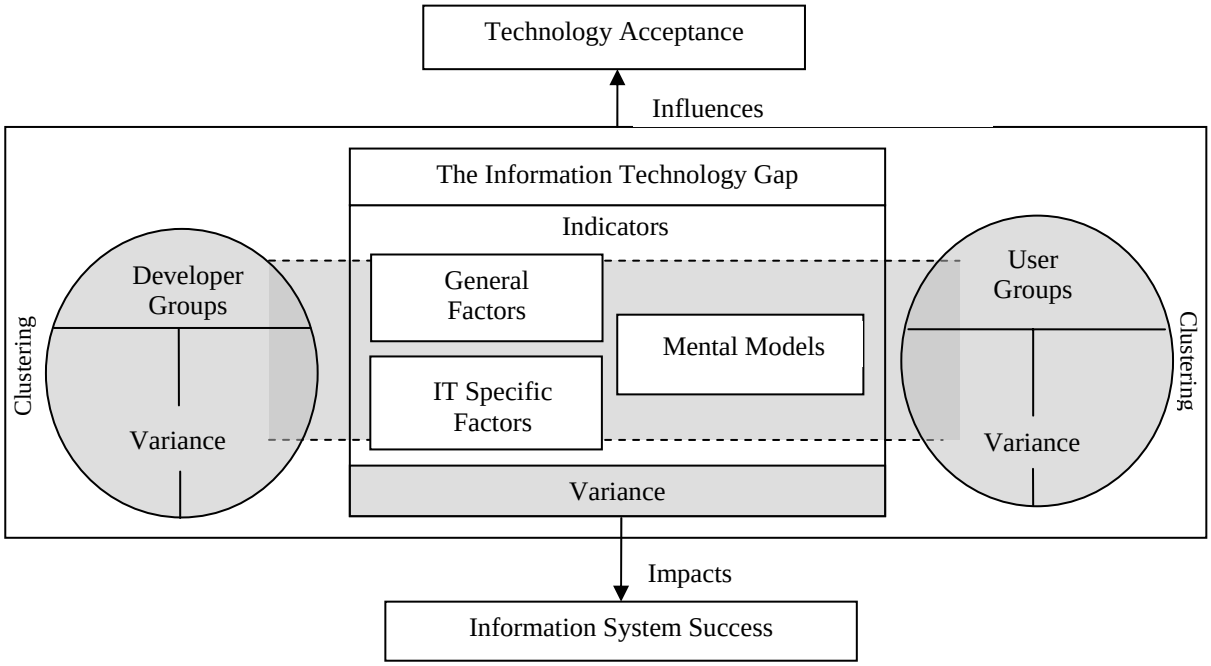

Figure 1: The Gap Model

The information technology gap is represented by the factor groupings, with IT professionals demonstrating a specific set of attributes for these factors and users demonstrating a different set of attributes. It is acknowledged that individuals will vary within each group and attributes for the factors for different individuals will be found across the spectrum regardless of the speciality of the individual, however it is expected that users and IT professionals will cluster. It is proposed that the different attributes for the factors will influence the likelihood of an individual to accept technology and that the variance between IT professionals and users will affect communication and interaction between the two groups impacting on information system success.

General Factors

General Factors include demographics and socioeconomic characteristics as shown in Table1.

Primary Factor	**Indicator**
Demographics	Age
	Education
	Employment (Position)
	Gender
Socioeconomic characteristics	Economic Status
	Family status

Table 1: General Factors

Age and education are factors that are widely viewed as influencing technology acceptance (Benbasat and Dexter 1982, Mock et al. 1972, Taylor 1975). Smith (1997) views younger individuals as likely to take to technology more easily than older individuals, and the level of education and training an individual has had as influencing their interaction with technology. Rogers (1995) does not view age as an influencing factor but does describe individuals with a higher level of education as having a favourable attitude towards education and science and more likely to adopt new technology. Dillon and Morris (1996) suggest that age, education and training are influences rather than defining characteristics for technology acceptance and it is felt that this is an accurate view. Anecdotal evidence suggests that these factors are becoming less relevant as an influence as technology becomes more pervasive and is routinely introduced to children as part of their schooling.

Employment has been described as influencing technology acceptance. Smith (1997) suggests that new employees may have a more positive response towards information systems than more established employees. Rogers (1995) lists work focus as influencing technology adoption, with a commercial economic view associated with a positive attitude towards technology.

Gender has been described as affecting patterns of behaviour towards technology (Smith 1997, Ramamurthy et al. 1992). Additionally, Rogers (1995) lists socioeconomic traits as an influencing factor on technology adoption, with higher social status and economic standing linked to early adoption of technology.

Information Technology Specific Factors

Information Technology specific factors include such areas as experience, training, and the level of involvement an individual has had in information system design and development as shown in table 2.

Primary Factor	**Indicator**
Experience/Expertise	Experience Level
	Domain of expertise
Training and education	Specific tech training
	Tech as part of education
User involvement	Level of involvement in system design/development
	Attitude towards user involvement

Table 2: Information Technology Specific Factors

Experience/Expertise:

Mayhew (1992) states that users differ from designers and from each other in their degree of technical sophistication. Cavaye (1995) discusses problems with the ability of users and developers to communicate with each other stemming from differences in the understanding each possesses of the technology, tasks involved and the system environment. Igbaria (1993) and Alavi and Joachimsthaler (1992) also cite experience as a factor influencing technology acceptance, and Ramamurthy et al. (1992) discuss domain expertise and experience, and system experience.

Owen (1986) suggests that professionals use their existing knowledge about the world to form the basis of their personal naïve theory of computational objects – an informal understanding based on individual experience. He states that knowledge concerning technology and the procedures available (and those that are "sensible" to use) in a technological sense are not necessarily evident to a less experienced individual, and this combination introduces a significant potential for problem solving difficulties to occur.

Training and education:

User training is a factor that can affect the interaction of an individual with technology by influencing satisfaction and confidence (Torkzadeh and Dwyer 1994). Mayhew (1992) cites technical education as a factor that varies between users and designers and Alavi and Joachimsthaler (1992) cite training. Borgman (1987) has also completed research linking not only the training an individual receives in a specific information system but also their general level and field of education with their performance and confidence with technology.

User involvement:

Ives and Olson (1984) define user involvement as "the participation in the system development process by representatives of the target user group" (Ives and Olson, 1984). User involvement is widely discussed in usability literature in relation to information system acceptance and success. User involvement in system development may also impact on an individuals perceptions of technology.

Mental Models

Byrne (1992) describes mental models as an internal representation of the external world that allows manipulation of different concepts and predictions, and allows inferences to be made of that manipulation. They are specific to an individual reflecting the attitudes and opinions that influence the reactions and behaviour of the individual. For the purpose of the Gap Model a mental model consists of personal factors including an individual's attitude towards technology, personality and communication behaviour as shown in table 3.

Primary Factor	**Indicator**
Attitude towards technology	Confidence
	Enthusiasm
	Fear of technology
	Motivation (type and degree)
	Feeling of Control
	Image
	Understanding of other's attitude
	Approach to innovation
Personality	the need for achievement
	Fear of failure
	degree of defensiveness
	locus of control
	Dogmatism
	Risk Taking Propensity
	Attitude to Change
Communication behaviour	Exposure to Media
	Interpersonal Communication methods
	Social network

Table 3: Personal Factors

Attitude towards technology

Payne (1992) states that the way an individual interacts with technology is dependant on their beliefs and attitudes in relation to that technology. Confidence can be defined as the individual's feelings of assurance or certainty about an information system (Bailey and Pearson 1983). Dillon and Morris (1996) cite factors such as a sense of mastery as favouring user acceptance of technology, however also acknowledge that evidence supporting this link is minimal.

Mayhew (1992) describes a relationship between anxiety and fear and the error rate of an individual called an arousal-performance relationship curve. An anxious or fearful individual may have a high level of arousal due to increased stress resulting in a higher level of errors, and users may find their performance impeded and error prone, possibly resulting in a fear 'loop' where negative experiences add to the anxiety and fear that a user feels.

Mayhew (1992) also lists motivation as a differing factor between users and designers. She describes the impact the motivation of an individual has on their interaction with an information system using the arousal-performance relationship curve, where a low level of motivation due to apathy results in a higher number of errors and an impeded performance.

Dillon and Morris (1996) describe feelings of control as influencing technology acceptance. They state that when users feel a lack of control they experience a rise in resistance towards technology. Smith (1997) describes the degree to which users believe they have self control over a system as an influence on their interaction with the system. He also states that failure experienced with one information system may influence interaction with other systems.

A range of other factors are mentioned in literature. Rogers (1995) lists personal and career aspirations and empathy as influencing factors, with higher aspirations and a higher degree of empathy with others associated with earlier technology adoption. Rogers (1995) also describes early adopters of technology as more like to actively seek out innovations and have a higher degree of knowledge about innovations.

Personality

Factors associated with personality are mentioned by many authors, including Alavi and Joachimsthaler (1992), Borgman (1987), Ramamurthy et al (1992), and Smith (1997). Personality traits specific to IT include the need for achievement, degree of defensiveness, locus of control, dogmatism, and risk-taking propensity (Gingras 1977; Zmud 1979; cited in Dillon and Morris (1996)).

Rogers (1995) describes early adopters as less dogmatic, more able to adapt to uncertainty and cope with risk, and more accepting of change. He also suggests that they have a high need for achievement,

Communication behaviour:

Rogers (1995) discusses a range of communication behaviour that determines the likelihood of an individual to adopt technology. Early adopters have a higher degree of social participation and are more highly connected within their social system. They also have a higher degree of orientation outside their social system. They have a broader exposure to varying media and interpersonal communication channels.

CASE STUDY FINDINGS

Two sets of interviews with IT professionals and users have taken place. Early findings from this small group of interviews involving fifteen people revealed some interesting discrepancies between IT professionals and users. The general group of factors showed little differentiation, with similar variations within the group in terms of age, education, level of employment, and socioeconomic standing. It is worth noting that the majority of the interviewees were under the age of 35, and as such routinely received exposure to information technology and systems while still at school. When examining technology specific and mental model factors however larger differences appeared. The greatest differences are summarised in Table 4.

Factor	**IT professionals**	**Users**
Technology as a Tool or a Toy	Tool at work, toy outside work	Tool
Confidence with technology	Highly confident with using technology, less confident with the stability and capabilities of technology.	Less confident with technology, more confident with the stability and capabilities of technology.
Enthusiasm towards technology	Highly enthusiastic, view technology as part of all aspects of their lives	Less enthusiastic, cautious, lower ‘care factor’
Type and degree of motivation to use technology	Pre-existing interest, challenge, fun, highly motivated to use technology	Work related use, less motivated to use technology
Feeling of control over technology	In control of the technology	Lower feeling of control, ‘helpless’ when difficulties arise
Risk Taking Propensity	Generally risk takers	More conservative
Approach to innovation	Actively seek and use new technologies. Variations between IT professionals on innovation acquisition	Cautious with new technology
Attitude to change	Embrace change	Comfortable with change, however do not seek it out.

Table 4: Greatest variance between IT professionals and users

Users were more likely to think of technology from a business viewpoint and to see it as a tool. IT professionals were more likely to use technology as a tool within the workplace, and use it is a toy outside that environment. IT professionals were generally more enthusiastic about technology than users and saw opportunities for technological applications in arena’s that users did not see as either opportunities or as generally desirable. IT professionals enjoy using technology and demonstrate intrinsic motivation. Users are more likely to use technology as part of their work and are unlikely to carry that use outside the work arena. That being said, users will use the internet and email facilities at work for personal use. IT professionals feel in control of the technology they use, and users describe a lower feeling of control and a feeling of helplessness when the technology does not work as they expect. IT professionals and users vary greatly in their risk taking propensity, with IT professionals more likely to be risk takers. IT professionals show some variation in their propensity to seek out and obtain new innovations. IT professionals with a technical focus actively follow new technological developments and seek to obtain these new innovations as soon as they are available. IT professionals with a more user and business related focus actively follow new technological developments, however they will only

obtain these innovations where they can see a specific application within their own environment. Users are more circumspect, preferring to see a new tool proved first.

Neither IT professionals or users described a fear of technology, a concern with how technology relates to their image, a fear of failure, or a high level of dogmatism. Both IT professionals and users had mixed positions in relation to the need to achieve, both exhibit some defensive characteristics, and both exhibit varying degrees of the need for control over a situation. Similarly, the stance of both groups in relation to communication behaviour varied within each group. Neither IT professionals or users describe themselves as fearful of change, however IT professionals were more likely to openly embrace change.

An interesting observation was made comparing users experience with and use of technology with their self-assessed knowledge of and confidence with technology. Several users interviewed use technology as an everyday part of their work and have extensive experience dating back to school. One stated that others in her office would come to her for assistance when they encountered difficulties. However, this group continually referred to their lack of experience, knowledge and aptitude for technology. This does not appear to be false modesty on the part of the participants, rather it appears to stem from a view that information technology is not their specialty, therefore they could not possibly be well versed in its application.

Differences within the IT professionals group

Individuals within the IT professionals group shared similar attributes for each of the factors identified in the model. In a number of factors the group separated into two distinct subgroups. These factors are identified in Table 5.

Factor	**Technically focused IT professionals**	**User and Business focused IT professionals**
Work Preference	Prefer to focus on technical roles and minimise contact with users	Enjoy interacting with users and the challenge of obtaining requirements.
Technology as a Tool or a Toy	Tool at work, toy outside work	Primarily a Tool, some toy usage outside work.
Approach to innovation	Actively seek, obtain and use new technologies.	Follow new developments, only obtain innovations that are relevant to them.
Understanding of others	Do not have an accurate understanding of users, tend to be arrogant in discussing users.	Have a fairly accurate understanding of users.
Communication	Are uncomfortable in an interview situation, do not like to discuss themselves.	Are relaxed and comfortable in interviews, discuss issues freely.

Table 5: Differences within the IT professionals group

IT professionals separated in two areas: their attitude towards the technology itself and towards users. Those with a technical focus not surprisingly are drawn to jobs with a technical orientation. They prefer not to interact with users where possible, and do not have an accurate understanding of users attitude towards technology. Their approach is to adapt users to the technology. One IT professional stated that users should be involved in system development "so they accept the reasons behind the technology". He also felt that "users are scared of change and need to be educated". When discussing technology they are very enthusiastic. They view technology as both a tool and a toy and they enjoy playing with technology. Their primary interest is in the technology and what they can make it do. They actively seek out new innovations and developments and will obtain and use these as soon as possible. In a personal sense, technically focussed IT professionals appeared uncomfortable when interviewed and did not like to discuss themselves.

IT professionals with a business or user focus were more relaxed in interview situations and general discussions and provided information easily and freely. They were drawn to positions that involved interaction with people and demonstrated a higher degree of understanding of users. They primarily view technology as a tool, and although they are still interested in new developments and innovations they are only likely to acquire these if they can see a direct use for them in their work. Their main focus is what they can make technology do for users.

A point to note is that IT professionals generally attribute user's reticence to use technology to fear whereas users do not describe themselves as fearful of technology. They demonstrate decreased enthusiasm and interest and a lack of confidence rather than fear. They acknowledge that information technology is pervasive and that they will be faced with using it in a variety of situations. One interviewee stated "since 'technology is the way

of the world' I don't feel strong enough to want to work against it so I'm better to try and roll with it than to defy it."

Differences within the User group

Individuals within the user group shared similar attributes for each of the factors identified in the model. In a number of factors some members of the group demonstrated similar attributes as those shown by IT professionals. These factors are identified in Table 6.

Factor	General Users	IT sympathetic Users
IT specific training	Exposure to IT at school and/or university, minimal specific IT training	Specific IT education and/or training at a tertiary or work level
Involvement in IS development	Minimal or no involvement in system development	Large degree of involvement in system development
Confidence	Low level of confidence in using technology, regardless of the amount of exposure to technology at work	More confident in using technology, or in being able to locate information required to use technology
Enthusiasm	Low level of enthusiasm towards technology	More enthusiastic about technology and its use
Motivation	Work related motivation to use, less motivated to use technology	Motivation becomes related to interest, more motivated to use technology
Control over tech	Feel that technology has control over them	Some degree of control over technology is evident

Table 5: Differences within the User group

The biggest factor influencing these differences would appear to be training and involvement in IS development. Users who demonstrated attributes similar to IT professionals had either received a technically oriented education and training or had participated in IS development. In the latter case, IT sympathetic users stated that prior to this involvement their feelings and attitudes were similar to those expressed by the majority of users.

The Gap and Information System Development Success

The interviewees from the case study used for this research consisted of the project manager, a business analyst, an international intern working with the development team, two developers, and two user representatives. Individuals from each side of the range identified for IT professionals and users were found to be present.

All interviewees openly discussed the different experiences they had encountered when interacting with a technically focused IT professional and a user or business focused IT professional. The primary factor that influenced their attitude towards the interaction appeared to be communication, with all interviewees describing negative attributes for their experience with a technically focused IT professional and positive attributes for their experience with a user or business focused IT professional. They described specific instances of interaction citing such difficulties as an inability to understand a technically focused IT professional in terms of language, and a feeling that the technically focused IT professional did not understand what they required. In contrast, encounters with a user or business focused IT professional were described positively and in some instances a user or business focused IT professional was used to overcome interaction difficulties with a technically focused IT professional. The international intern working on the team described one of the user or business focused IT professionals as "able to explain things at any level. He could talk to the users and they knew what he was saying, then he'd talk to Developer2 [a technically focused IT professional] in her own language". The presence of several user or business focused IT professionals appeared to assist the requirements gathering phase of the project and ultimately the positive result generated when the product was delivered. Doubts were expressed by several interviewees as to the possible outcome of the project had these individuals not been present.

One of the user representatives interviewed had very little understanding of information technology when she first commenced on this project. She was heavily involved with the design and development of the information system, and described how the experience had altered her initial attitudes. Specifically, when first interviewed she described a lack of confidence with and interest in technology. Her use of technology was work related and she felt that she had very little control over the technology itself. When interviewed again at the end of the project this had changed and she demonstrated confidence with technology and stated that now she felt more in control. She was more likely to use technology outside of the work place and stated that she had a better understanding of what was involved in information system development and what could be achieved by

technology. Her enthusiasm had increased although it was still below the level exhibited by IT professionals. She felt that the insight and understanding afforded her by her involvement in the project assisted her in contributing to the process by providing her with more confidence to request specific elements for the application. It also made her more able to relay her requirements and gave her a better understanding of what could be realistically achieved.

Initially, the project has been deemed a success in terms of meeting the defined project requirements, passing the testing phase, and satisfying the project manager, project sponsor and project originator. They have been pleased with the development of the application, however they have expressed concerns as to the ongoing requirements of the project as the user focused IT professional primarily responsibly for development has now left, and the IT side of the application is now in the hands of a technically focused IT professional. As the development is an internet based application for public use, the ultimate success of the project will be determined by its utilisation by the broader community and usage statistics are being monitored for this purpose.

CONCLUSION

Differences between IT professionals and users do exist, forming a gap between the two groups. Attributes identified in literature from a range of research areas as relevant for examining IT professionals and users were used to develop a Gap Model. This model was used to analyse findings from an initial set of interviews with IT professionals and users.

Some of the factors claimed in literature to be of importance have not been found to be important from the research conducted to this point. Specifically, demographics have been used to classify an individual, however the findings from an initial set of interviews have found that differing attributes for these factors are not reflected in the attitude of users or IT professionals towards technology. Further research may demonstrate that age may have relevance, but this may be attributed to the degree of exposure an individual has had to technology, with those under the age of 35 to 40 having had some exposure at school. It appears that the factors having the greatest impact on users attitude towards technology are technology specific education and training, and the degree of involvement an individual has experienced with IS development. At present, no specific factors have been identified as influencing the propensity for a technical focus or a business or user focus for IT professionals.

The differences that do exist reflect fundamental misunderstandings with the potential to adversely impact IS development. Levels of confidence and enthusiasm vary greatly between the two groups and IT professionals and users express differing opinions of what can or should be achieved using technology. The differences have also influenced the conduct and ultimate success of the information system development project examined in initial case study research.

At this point the Gap Model has only been used to analyse a small amount of information. It is clear that further work needs to be undertaken to support early findings and clarify which factors show the actual differences between IT professionals and users and refine the model. Research is continuing to that end.

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