RUNNING HEADER: Human Development

KAM 2

Theories of Human Development

Human Development And Technology

Walden University

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Ph.D. in Applied Management and Decision Science

Organizational Change Management

Assessor: Professor Earl Joseph

December 6, 2002

8210 Breadth Abstract

This paper explores human development with an emphasis on human behavior. A general review of development is provided along with a more specific look at human development. Specific topics, including learning, motivation, and control are explored in the context of human development. A brief discussion of the link between technology any human development is also provided.

8222 Depth Abstract

This paper explores the relationship between technology and human development. The paper takes a historic view of the issue and then looks at recent events. The paper focuses on technology, the human environment, and learning. Different perspectives are explored as well as a look into deeper issues of how the relationship between technology and environment affects each of them. Also contained in this work is an annotated bibliography of recent articles on the various subjects contained in the paper. The paper concludes with a summary and suggested areas of additional study.

8232 Application Abstract

This paper explores how the existence of video games, in a home environment, affects the need for technical support for computer users in the workplace. It explores current historical events and theories from recent publications. A survey is conducted using one hundred eighty five computer users in a Fortune 500 company to determine how exposure to video games can help predict the level of support a computer user will need. The results of the survey are presented as well as recommendations for future research.

RUNNING HEADER: Human Development

SBSF 8210 - KAM 2 Breadth

Principles of Human Development

Human Development and Technology

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First Assessor: Prof. Earl Joseph

Faculty Mentor: Prof. Earl Joseph

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Introduction

This research paper will focus on human development and how humans direct their efforts toward changing themselves and their environment. Three authors will be used to provide the basis for this research. Cited works by Albert Bandura, Jean Piaget, and B. F. Skinner will be used. These three authors look at human development in three different ways.

Albert Bandura focuses on the theory of social learning. He focuses on how individuals observe and emulate behavior. He shows how this learning process affects human development. This observation and emulation of behavior can be traced to society as a learning environment (Bandura 1977).

Jean Piaget observes development at the evolutionary level. In his writings, he shows how cellular development is a response to the environment. This response is classified as development. His writings take a systemic look at development that can be used when evaluating cellular, insect, or human development (Piaget 1978).

B. F. Skinner takes a very scientific view of the study of human behavior. In his book, he describes the results of controlled experiments. He describes how

scientific research in human behavior is designed and performed (Piaget 1978).

In this KAM, I will explore research pertaining to human development in the areas of motivation, environment, and learning. I will focus on these aspects because they have the potential to help explain how technology has played a part in the development of human behavior.

Technological advances are part of the natural development of humans and their societies. Advances in knowledge and technical understanding lead to the production and application of new technology which then causes changes in society (Norman 1981). Collin Norman describes it this way:

> Technology development, according to this view, is an evolutionary process, not unlike biological evolution. We even speak of new generations of computers, automobiles, and other high-technology goods as if they were biological descendents of earlier models, and key technical developments are often regarded as the progenitors of a whole range of subsequent innovations (Norman, 1981, p. 20)

Historically, many social changes have been determined by technology. The introduction of technology changes the way society functions. “This concept lies unstated behind such

terms as the Bronze Age, the Machine Age, and the Computer Age" (Norman, 1981, p. 20).

Looking at the evolution of technology and idea that social change follows technological advancements, one can draw correlations between the development of agricultural technology and the rise of the cities in Sumeria as the land was able support more people. The development of steam power made the machines of the industrial revolution possible (Norman 1981).

Like biological evolution, technical evolution is either nurtured or defeated by the forces surrounding it. The ancient Greeks actually invented steam power (Norman 1981). Norman observes that:

> Technical evolution, like biological evolution, responds to a variety of forces. Biological evolution is driven by environmental pressures that favor the survivability of some species over others-insects resistant to an insecticide will swiftly predominate in a sprayed area, for example-and the key to the development of living things can be found only by looking at them in relation to their environment. Similarly, the key to technological development lies in the environment in which technological change takes

> place-in this case, the social, economic, political, and physical environment (Norman, 1981, p. 21).

Cause-and-Effect of Behavior

Jean Piaget describes “behavior” as “All action directed by organisms toward the outside world in order to change conditions therein or to change their own situation in relation to these surroundings” (Piaget, 1978, p. ix). He cites searching for food and using tools as low-level examples of this type of sensorimotor action. At higher levels examples include intelligence and mental operations.

Paiget discusses the theory that behavior influences the way certain organs develop. The origins of actions or habits are determined by environmental circumstances and that these habits evolve within the framework of a process of global organization (Piaget 1978). When viewed in this light, the way a nervous system or other internal organs develop is a form of behavior because these are examples of how organisms react to external stimuli. Organisms learn from and modify themselves as they respond to their surroundings. This gives rise to the idea of social learning. The theory of social learning assumes that “people and their environments are reciprocal determinants of each other” (Bandura, 1977, p. vii). Behavior results

from the interactions of persons and situations. Persons and situations are independent entities that combine to produce behavior (Bandura 1977). Bandura says “personal and environmental factors do not function as independent determinants, rather they determine each other” (Bandura, 1977, p. 9). He goes on to state that “The relative influences exerted by these interdependent factors differ in various settings and for different behaviors” (Bandura, 1977, p. 10). In the past, scientists looked at causes and effects when studying behavior. Now, a cause is looked at as a change in an independent variable and an effect is a change in a dependent variable. Skinner says:

> The old “cause-and-effect connection” becomes a “functional relation.” The new terms do not suggest how a cause causes its effect; they merely assert that different events tend to occur together in a certain order (Skinner, 1965, p. 23).

When studying the causes of human behavior, any condition or event which can be shown to have an effect on behavior must be taken into account (Skinner 1965).

The behavior of all organisms is affected by their surroundings Piaget cites these examples in a study of butterflies:

> The butterfly moves toward the top of the wall, climbing if the surface is rough, flying if it is smooth. Next it turns around so its head is pointed downward. Last comes the animal's adjustment of its position in function of light sources. Where there is only one such source, the body is oriented toward the light and the head turned away; if there are two or more sources, an intermediate position is taken up, the aim being in all cases that the two eyes be exposed to an equal-but minimal-amount of light (Piaget, 1978, p. 60).

Looking at this example, one can see that, in this case, an insect's behavior is dependent on several factors or changes in the dependent variables that define its surroundings. This supports Bandura's ideas of social learning and the cause-and-effect of environmental stimuli on responses. Bandura says:

> In the social learning view, people are neither driven by inner forces nor buffeted by environmental stimuli. Rather, psychological functioning is explained in terms of a continuous reciprocal interaction of personal and environmental determinants. Within this approach, symbolic, vicarious, and self-regulatory

> processes assume a prominent role (Bandura, 1977, p. 11).

From the perspective of social learning, human nature has a vast potential that can evolve by direct and vicarious experience into many forms (Bandura 1977).

Behavior and Motivation

Human behavior is selective. Humans learn many kinds of behavior but choose their actions and responses from a variety of direct and vicarious experiences. Bandura describes motivational processes when he says:

> Social learning theory distinguishes between acquisition and performance because people do not enact everything they learn. They are more likely to adopt modeled behavior if it results in outcomes they value than if it has unrewarding or punishing effects (Bandura, 1977, p. 28).

The same holds true for behavior that is learned through observation. Behaviors that appear to work positively for others are favored over those that are perceived to have a negative effect (Bandura 1977).

Behavior is often motivated by reinforcement from other people. One reinforcer is that of *attention*. A child misbehaves to get the attention of others. Approval

is also a reinforcer, especially when it is coupled with attention. These two reinforcers become stronger, yet, when combined with affection (Skinner 1965). A child's behavior can be modified from misbehaving to behaving through the proper application of these reinforcers.

One of the strongest reinforcers of behavior is the token. The most common example of this is money. Although money does not buy everything, it can buy a variety of other reinforcers. When money is the reinforcer of behavior, a sharp correlation between behavior and consequence can be established. Skinner explains it this way:

> When we are paid in money, we know what our behavior has accomplished and what behavior has accomplished it. The reinforcing effect can also be more successfully conditioned: the exchange value of money is more obvious than that of attention, approval, affection, or even submissiveness (Skinner, 1965, p. 79).

Money, however, is not the only token. In education, grades are considered tokens because it is perceived that they can be traded for something of value in the future (Skinner 1965).

Bandura seems to agree on the point of money being a strong motivator of behavior when he says:

> People do a lot of things for money, or to gain access to enjoyable activities. Social commentators who voice objections to the use of extrinsic incentives would cease many of their own activities if they were no longer paid to do them (Bandura, 1977, p. 114).

Both authors agree that there is a strong correlation between behavior and financial incentives. Money is an excellent motivator and many people would not do the things they do without getting paid.

Environment

Behavior must be appropriate to the occasion. If one does not keep in touch with reality, then behavior can become psychotic. However, behavior that is irrational can still be linked to responses to the environment. Skinner says:

> Failure to keep in touch with reality leads to the kinds of difficulties often observed in psychotic behavior. Even when a man is engaged in rejecting the world, in systematically reducing certain forms of its control over him, he is physically interacting with it (Skinner, 1965, P. 129).

Interaction with an environment affects the behavior of all organisms. This behavior determines the evolution of organisms and leads to an equilibrium state between the organism and its environment (Piaget 1978). Paiget contends that the natural evolution of organisms, even the organs within the body of a human, show behavior traits because that evolution is a reaction to the environment that surrounds them (Piaget 1978).

Bandura touches on the environmental aspect when he talks about how children learn through imitation. He references Piaget's development of imitation. He asserts that children imitate their environment. This imitation is part of their social learning. As children develop, their capacity to imitate behavior observer in their environment becomes more refined (Bandura 1977). They learn how to try out new observed behavior and perfect it over time. Bandura describes it this way:

> As children's intellectual development progresses, they become capable of delayed imitation of modeled performances which they cannot see themselves make. These changes presumably come about through coordination of visual and sensorimotor schemata and through differentiation of the children's own actions from those of others. They now begin systematic

> trial-and-error performance of responses until they achieve good matches to new modeled patterns (Bandura, 1977, p.33).

This trial-and-error imitation of behavior is similar to the trial-and-error development process in cellular evolution. Both are reactions to an environment, and both represent the experimental process of finding out what works and what does not.

When studying the environment that controls development, one must look at the independent variables that define it. The physical description includes things like touch, smell and taste. These are the chemical and physical conditions and events which have an effect on behavior. Not all variables have an effect on every organism. The organism being studied must be able to perceive the variable (Skinner 1965). Skinner describes it this way:

> The kinds of events which stimulate the organism are effective only within certain limits. We hear sound, but only of certain pitches and intensities. We see light, but only of certain intensities and wave lengths. The limits of stimulation, and also the smallest differences in stimuli which make detectable

> differences in behavior, have been extensively investigated (Skinner, 1965, p. 131).

The converse effect is true when you look at the subject being stimulated. Deaf and blind subjects are not stimulated by sounds and colors that they cannot perceive (Skinner 1965). This, in some ways, explains the differences in development by subjects exposed to the same environment. This, of course goes beyond the ability to see and hear.

Learning

As we have seen, so far, behavior is the response to the stimuli if an environment. Behavior develops, or is learned, as organisms react to their environments and watch others do so. Trial-and-error experimentation occurs as different responses to stimuli are tried.

In social settings, behavior can be observed before it is performed. Humans can model behavior before performing it. New behavior patterns can be organized from observations of old patterns. Responses can be linked and reinforced to form new patterns of behavior (Bandura 1977). Just as behavior can be modeled and influenced through reinforcers such as money. The observation of this motivation by others can have an effect on behavior through

its social learning benefits. Higher level beings, like humans, can acquire complicated sequences of responses even though they do not perform them right away (Bandura 1977). People can combine observations to develop individual patterns. Bandura describes it this way:

> According to social learning theory, behavior is learned symbolically through central processing of response information before it is performed. By observing a model of the desired behavior, an individual forms an idea of how response components must be combined and sequenced to produce the new behavior. In other words, people guide their actions by prior notions rather than by relying on outcomes to tell them what they must do (Bandura, 1977, p. 35).

By reinforcing the desired behavior through monetary incentives, corporations create observable patterns of behavior that are inputs to the social learning of the employees. By setting up observable examples of how employees are rewarded through raises and promotions, employers establish perceived patterns of desired behavior that other employees can emulate. In fact, observational learning can be achieved more effectively by informing observers in advance about the benefits of adopting the

desired behavior than waiting for it to occur and then rewarding it (Bandura 1977).

Skinner notes that the English language contains words like “reward” and “punishment” to refer to the effect of this type of social learning. He discusses the study of operant behavior which is a process of behavior modification that increases or decreases the probability of specific behaviors through positive or negative reinforcement each time a behavior is exhibited (Skinner 1965). Unlike observational learning, this form involves the subject’s direct involvement with an event instead of merely observing an event. It is more useful in scientific research because the cause-and-effect model is more controlled and measurable. “In operant conditioning we strengthen an operant in the sense of making a response more probable or, in actual fact, more frequent” (Skinner, 1965, p. 65). Under good conditions the frequency of a response shifts from a prevailing low value to a stable high value (Skinner 1965).

Operant conditioning experiments also reveal the concept of operant extinction. When reinforcement is no longer present, a response becomes less frequent. Skinner says, “In general when we engage in behavior which no longer pays off, we find ourselves less inclined to behave

in that way again" (Skinner, 1965, p. 69). When behavior is enforced with the positive reinforcement of money, economic control is being placed on a subject. In a simple example, an individual is enticed to perform labor through the reinforcement of money or goods. When a person receives a tip for performing a small service, it increases the probability that that person will perform a similar service in the future (Skinner 1965).

Negative reinforcements usually come in the form of punishment. It works by subtracting responses where reinforcement adds them. Punishment is a powerful technique for social control. However, it is not always administered by another individual. Skinner cites some obvious examples:

> The burned child has been punished for touching flame. Eating unsuitable food is punished by indigestion (Skinner, 1965, p. 185).

Other forms of punishment, administered by others, include the spanking of a child, the firing of an employee, and the imprisonment of a criminal. In all of these examples, behavior is conditioned by responses. Learning occurs through both direct and observed contact with the cause-and-effect.

Another interesting form of punishment is that of self-punishment. This happens when people feel an internal sense of inadequacy or compromise. Bandura explains it this way:

> When people perform inadequately or violate their own standards of conduct, they tend to engage in self-critical and other distressing thoughts. During the course of socialization the sequence of transgression-internal distress-punishment-relief is repeatedly experienced (Bandura, 1977, p. 152).

In these cases, actual externally-administered punishment can provide a relief from internal mental anguish.

Positive and negative reinforcements are powerful tools for motivation and learning. Some teach desired behavior, some teach undesired behavior, and some reinforce the application of learned behavior to new circumstances yet to be learned.

Group Behavior

Social behavior is the behavior of two or more people with respect to one another and their common environment. The study of this type of behavior is different from the study of individual behavior. This addition of social situations has necessitated the creation of the social

sciences to create the language needed to describe the effects of social forces (Skinner 1965). Skinner says, “Social behavior arises because one organism is important to another as part of its environment” (Skinner, 1965, p. 298. The fact that people gather in groups creates situations involving war, government, economics, and cultural practices. Human responses to these external environmental forces leads to the study of group behavior.

One aspect of the social environment is that of social reinforcement. Most social reinforcements require the presence of other people. In social behavior, special emphasis is placed on reinforcements such as approval, affection, and submission which usually require another person to be administered. Negative reinforcement, such as punishment, are often administered by others in the form of such actions as adverse stimulation, disapproval, and ridicule (Skinner 1965).

When behavior is reinforced through other people, instead of the mechanical environment, it is often more flexible and is dependent upon individual, unique situations. Skinner says:

> Social reinforcement varies from moment to moment, depending upon the condition of the reinforcing agent. Different responses may therefore achieve the same

> effect, and one response may achieve different effects, depending upon the occasion. As a result, social behavior is more extensive than comparable behavior in a non-social environment (Skinner, 1965, p. 299).

Since the reinforcing entity may not always be consistent or appropriate, the reinforcement may be intermittent, and the length of the success of the reinforcement may have a varied pattern (Skinner 1965).

Bandura discusses the differences in the way reinforcements are structured in societies on an individual and a collective basis. In individualized systems, people are rewarded or punished in terms of their own actions. In collective systems, self-interest is subordinate to the welfare of the group. This is achieved by rewarding and punishing the entire group so that members are affected by each other's behavior (Bandura 1977). Social learning theory describes it this way:

> When people share the consequences of their decisions and actions, their interests are best served by committing their efforts to common goals, by helping each other, and by assuming mutual responsibility. Group-oriented contingencies are most prevalent in

> societies espousing a collectivist ethic (Bandura, 1977, p. 116).

Because different social groups require different incentive practices, no single structure is the best in every situation.

Control

In studying behavior, in the social setting, othe subject of control arises. In the individual setting, external forces exercise controls along with internal self-control. In the group setting, these individual controls are combined with those that govern individual and group behavior.

Skinner discusses techniques of control. Self-control refers to an individual controlling oneself. Other forms of control involve the control of others. Physical force is an immediate and effective control technique for those who posses the necessary power (Skinner 1965). Skinner cites the following examples:

> In its most immediately personal form it is exemplified by the wrestler who suppresses the behavior of his opponent through sheer physical restraint. The most extreme form of restraint is

> death: the individual is kept from behaving by being killed (Skinner, 1965, p. 315).

Other less extreme forms include the use of such things as handcuffs, strait jackets, or jails.

Reinforcement is another means of control. As stated earlier, money and goods are effective reinforcers. Others include praise and thanks. These, however are less reliable than money and goods (Skinner 1965). Bandura extends this concept to the idea of vicarious reinforcement. This occurs when observers increase behavior for which they've seen others reinforced. Bandura states:

> Results of numerous studies generally show that rewarded modeling is more effective than modeling alone in fostering similar patterns of behavior. Observed positive consequences are especially likely to foster adoption of behaviors that have unpleasant aspects and hence, require incentives if they are to be performed (Bandura, 1977, p. 119).

The same, but converse results occur with vicarious punishment. Observed negative consequences deter individuals from behaving in similar ways. The most extensive studies in this area have been with respect to physically aggressive behavior (Bandura 1977).

The strength of observed or directly-experienced consequences depends on the perspective from which they occur. Bandura says, “By attending to the pattern of successes and failures of others, observers generally learn faster than the performers themselves (Bandura, 1977, p. 122). This is due to the fact that observers can concentrate of interpreting the observations. The actual performers have the added task of responding to the stimuli at hand. Observers can focus on discovering the correct solution (Bandura 1977). Observed punishment is an effective performance inhibitor, however, one drawback to it is that it focuses attention to undesirable behavior.

When it comes to maintaining behavior over time, direct incentives have greater motivational effects than vicarious ones. Bandura states it this way:

> One would not advise employers to maintain the productivity of their employees by having them witness a small group of workers receiving paychecks at the end of each month. Seeing others rewarded may temporarily enhance responsiveness, but it is unlikely by itself to have much sustaining power (Bandura, 1977, p. 123).

Both vicarious and direct reinforcements occur simultaneously in daily life, it is the interaction of the two that truly affects behavior.

Conclusion

Simply put, human behavior is the reaction of a person to external stimuli. This reaction is an attempt to achieve equilibrium between the person and his or her environment by either changing the stimuli or changing themselves. Taking a systemic view of development, the same basic concepts hold true when studying the development of humans or the development of other organisms. An example of this is the development of a nervous system within a species. The network of nerves develops as the requirements for nerves increases as an organism develops (Piaget 1978).

This cause-and-effect relationship between the environment and human development extends to aspects of human behavior. Many variables come into play when studying human behavior. Not all factors, or stimuli, affect all people. For example, colors may not have any affect on the behavior of a blind person. This explains why people are affected differently by different stimuli (Skinner 1965).

This leads to the subject of social learning. Social learning occurs as people are exposed directly or vicariously to positive and negative reinforcements. These reinforcements take many forms, but one of the most effective is money. Money works both directly and vicariously as a motivator or reinforcer of behavior (Skinner 1965). People respond to direct monetary reinforcement in stable, predictable ways. Vicarious monetary reinforcement is, however, not sustainable in the long run (Bandura 1977). Social and group learning, along with effective control mechanisms can work together to generate desired behavior in a variety of social settings. Reinforcements that stress the welfare of the group over individual reward work to maintain productivity in the workplace, order in the classroom, and governmental stability. The key is to reach and maintain the equilibrium state that balances individual and group needs as well as needs between groups.

Technological advances are part of the natural development of humans and their societies. Advances in knowledge and technical understanding lead to the production and application of new technology which then causes changes in society (Norman 1981). In the depth component of this KAM, I will explore how technology has

played a part in maintaining or disrupting the equilibrium mentioned above.

Bibliography

Bandura, A. (1977). Social learning theory. Englewood Cliffs, N.J., Prentice Hall.

Norman, C. (1981). The god that limps: Science and technology in the eighties. New York, W. W. Norton.

Piaget, J. (1978). Behavior and evolution. New York, Pantheon Books.

Skinner, B. F. (1965). Science and human behavior. New York, NY, Free Press.

RUNNING HEADER: Human Development

SBSF 8222 - KAM 2 Depth

Current Research In Human Development

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Annotated Bibliography

Burn, J. M. and K. D. Loch (2001). "The societal impact of the World Wide Web--key challenges for the 21st century." Information Resources Management Journal **14**(4): 4-14.

This article explores the impact of the World Wide Web (WWW) on today's changing society. The article examines the societal effects of information technologies on human development. It focuses on developing societies and the cultural factors that inhibit the deployment of technology.

The article looks at technology introductions in history and then examined what has happened since the introduction of the modern personal computer. It concludes with an examination of how developing countries might use the WWW to even the playing field with developed countries.

Research for this article comes from a review of current literature and other studies. This article contains a lot of statistical data to support other research material.

This article is relevant to my research because it directly addresses societal and human development as it pertains to the introduction of technology.

Coghlan, D. and J. McDonagh (2001). "Academic formation and IT-enabled change - a conspicuous relationship." Organization Development Journal **19**(1): 21-29.

This article addresses the issues of introducing new information technologies in work organizations. This article explores the role of academia in shaping the expertise of the Organizational Development community. The author explores how to organize IT-based competencies. The role of IT management is explored in centralized and decentralized scenarios.

Research for this article comes from a review of current literature. Studies of other research data and academic curricula are cited.

This article is relevant to my research because it deals with organizational development and change as it pertains to information technology competencies.

Derra, S. (1999). "Refocusing AI research on real-world applications." Research & Development **41**(5): 46-48.

In this article, the author explores the use of artificial intelligence (AI) to program new technology to a degree that gives it higher levels of autonomy. The article examines the role of advanced programming

techniques and products. It uses examples from NASA to show how AI is being used in space exploration.

This article is relevant to my research because it is an example of one of the concerns that exits in human development. The concern is that technology is taking over too much of the human function. The article describes how the technology is being used in places where humans cannot go.

Dilworth, R. L. (2001). "Shaping HRD for the new millennium." Human Resource Development Quarterly **12**(2): 103-104.

This article explores the changing role of human resource development (HRD) in the business world. This discipline is changing from the role of trainer to performance consultant. The article references the Research-To-Practice Committee that contains members from major companies such as IBM, Union-Carbide, General Motors and others. This committee is attempting to map out the future of the HRD profession.

The research for this article comes from other cited studies.

This article is relevant to my research because it addresses the fact that efforts are shifting from human resource development to that of a performance coach.

Fishkin, K. P., A. Gujar, et al. (2000). "Embodied user interfaces for really direct manipulation Embodied user interfaces for really direct manipulation." Association for Computing Machinery. Communications of the ACM **43**(9): 74-80.

The authors of this article explore how the development of the graphical user interface (GUI) changed human-computer interaction (HCI). This advancement changed HCI from a textual language to a graphical one. This has evolved into three dimensional virtual reality. The article goes on to discuss new devices including handheld computers, touch-screen sensors, and display devices.

Research for this article came from recent literature on the subject of handheld computing as well as some research from the labs of technology companies. It appears that some device vendor's literature was used as well.

This article is relevant to my research because it poses new ideas for how technology will be used in the future and how these changes could affect human development in the future.

Gaines, B. R. and M. L. G. Shaw (1999). "Embedding formal knowledge models in active documents." Association for Computing Machinery. Communications of the ACM **42**(1): 57-63.

In this article, the authors explore technology that allows users to create more advanced knowledge models. These models create a new symbolic language to express acquired knowledge. This formal language, used in expert systems, has the potential to change the way expertise is used and taught to humans.

This article is relevant to my research because it addresses potential changes in the way humans will develop intellectually, using this new technology in concert with internet technology.

Hawkins, D. T. (1999). "Information visualization: Don't tell me, show me!" Online **23**(1): 88-90.

This article discusses advances in information visualization technology. In it, the author discusses

how graphics and full text research, available online, has changed the development of research techniques. Researchers are able to receive more than simple lists of citations. These advances will change how learning will occur in the future.

Research for this article is from a review of current literature as well as resources from the internet. Several websites are recommended for additional information.

This article is relevant to my research because of the importance of learning and education in human development.

Kristol, I. (2001). "Is technology a threat to liberal society?" Public Interest(143): 45-52.

In this article, the author raises issues involving the science and technology and the future of a liberal democracy. A historical review of the Greeks and Chinese shows that those cultures developed technologies that were never applied in their societies. This had an effect on human development. The author goes on to address the social responsibility that engineers and scientists have.

This article is based on historical record as well as the views of the author and contributors.

This article is relevant to my research because it explores how technological advancements have played a role in human development and what might happen in the future.

Kurzweil, R. (1999). "Spiritual machines: The merging of man and machine." The Futurist **33**(3): 16-21.

In this article, the author explores a chronology of the future starting in 2009 and ending in 2099. In it, he theorizes how computers will permeate every aspect of human life and shows evidence of how they already are. He ascertains that, by 2009 the average household will have over one hundred computers and that by 2019, most workers will spend the majority of their time acquiring knowledge.

Research for this article comes from the author's experiences in the field of technology and his speculation for the future.

This article is relevant to my research because it explores a future alternative that, by using technology, would have a dramatic effect on human

development. While not factual, it serves as a framework for investigation.

Lehman-Wilzig, S. (2001). "Babbling our way to a new babel: Erasing the language barriers." The Futurist **35**(3): 16-23.

This article discussed new computer translation technology called Synchronous Automated Translation Systems (SATS). This technology, currently under development, translates languages while maintaining cultural aspects of individual languages. The technology will be able to translate the spoken word just as it is being heard. The article explores different aspects of communication including expressions, dialects, and body language.

This article is based on a literary review of recent advancement in language technology.

This article is relative to my research because it explores an aspect of human development, communication, and how technology may affect it in the future.

Leonard, S. (2000). "Doling out computers." HR Magazine **45**(5): 240.

This article examines how the deployment of home computers, by employers, affects employees. Ford Motor Company and Delta Airlines are cited as examples. The development of knowledge-based companies and the increased training needs are discussed.

Research for this article is based on the author's exposure to the subject matter through her experience in human resource management education.

The information contained in this article is relevant to my research because it explores learning options and technology. Learning is an important part of human development.

Loth, B., N. P. Brown, et al. (1999). "Reorganization impacts upstream technology." Oil & Gas Journal **97**(2): 55-59.

In this article, the authors examine corporate outsourcing and the effects on health and safety. The authors look at the oil industry in the UK, and the effects of downsizing and the subsequent outsourcing of activities. Personnel development issues are discussed.

This article is relevant to my research because it deals with organizational changes in industry and how those changes affect the human development controlled by employers.

Maccoby, M. (2000). "Creating network competence." Research Technology Management **43**(3): 59-60.

This article examines the development of human dialog and some of the effects of technology on it. The author discusses the development of interactive skills and technology tools such as PowerPoint and E-Mail. Heterarchical competencies and the ability to communicate across different communities in an organization.

Research for this article seems to come from the author's experience as a consultant in the field of leadership and organizational change.

This article ir relevant to my research because it explores the development of communication techniques in business organizations.

McDonagh, J. (2001). "Not for the faint hearted: Social and organizational challenges in IT-enabled change." Organization Development Journal **19**(1): 11-20.

This article examines the perception that industry's investment in information technology has not produced the expected benefits. The author references The California Department of Motor Vehicles, Hilton Hotels Corporation, FoxMeyer Drugs, and Dow Chemical as examples of technology implementations that failed to produce expected results. Lack of strategies, attention to organization structure and culture, and attention to systems implementation were listed, among other things, as contributing factors to the failures.

The information presented in the article is the result of an extensive literary review. This article is somewhat unique in that it looks at elements of human development and behavior in its explanation of the results of IT performance.

This article is relevant to my research because it deals with behavior patterns relevant to the introduction of technologies in organizations.

Strambach, S. (2002). "Change in the Innovation Process: New Knowledge Production and Competitive Cities—The Case of Stuttgart." European Planning Studies **10**(2): 215-231.

This article addresses the move to a knowledge based economy and potential changes in the innovation process. The author addresses technical and non-technical innovations. She references knowledge intensive business services (KIBS). These services provide non-material intangible services. These services include; the transfer of technical and managerial knowledge, best practices, the adaptation of knowledge to clients' needs.

Research for this article is from an extensive literary review. Government commissioned studies from around the world are also referenced.

This article is relevant to my research because it explores new social services that will enhance human development.

Sutherland-Smith, W. (2002). "Weaving the literacy Web: Changes in reading from page to screen." Reading Teacher **55**(7): 662-669.

The author of this article explores the unique reading strategies needed for the World Wide Web. Changes to teaching methods are needed when reading is taught using a computer. Classroom teaching practices were evaluated in Australia. She says that students

must become more proficient in analyzing information so that a level of understanding can be reached. The author focuses on additional skills such as searching, understanding key-words, and basic technology.

Research for this article comes from an extensive literary review of articles written on the subject.

This article is relevant to my research because it explores how changes in technology will require changes to the way people learn and develop analytical skills.

Turk, M. and R. George (2000). "Perceptual user interfaces." Association for Computing Machinery. Communications of the ACM **43**(3): 32-34.

In this article, the authors start by stating that human-computer interaction (HCI) has remained the same for the past two decades. He states that graphical user interfaces (GUIs) have followed the WIMP (windows, icons, menus, pointer) paradigm which has provided a standard, stable and global face to computing. The authors propose that the human interface of the future will need to be more aligned with how computing devices will be used. They call these perceptual user interfaces (PUIs). New devices

and sensors will perceive human communication channels and generate output that is naturally understood.

Research for this article came from a workshop presented by Microsoft. The article would have been better if some additional supporting sources of information had been used.

This article is relevant to my research because it proposes new technological capabilities that will affect human development by imbedding more technology into human life.

Williams, S. W. (2001). "The effectiveness of subject matter experts as technical trainers." Human Resource Development Quarterly **12**(1): 91-97.

This article discusses the role of technical trainers in the workplace. It states that thirty three percent of all training delivered in business and industry involves information technology. This type of training requires a different level of expertise than usually exists with the generalist trainers in the typical human resource department. It requires more of a subject matter expert who is trained in adult learning theory and training techniques.

Research for this article came from a review of literature publish on the subject.

This article is relevant to my research because it looks at technology and learning theory which is an important aspect of human development.

Winn, J. K. and J. R. Wrathall (2000). "Who owns the customer? The emerging law of commercial transactions in electronic customer data." The Business Lawyer **56**(1): 213-271.

This article explores ways that the information revolution have changed the way commerce is transacted and the value of the information gathered through business transactions. Customer databases are important corporate assets. The article tells how commercial law has not kept up with advances in customer database technology. The author explores some case studies in database rights and disputes with several companies including Travelocity.com, RealNetworks, First Union.

Research for this article comes from case studies as well as legal doctrine. Several regulations are cited in the work.

This article is relevant to my research because it explores legal and cultural issues associated with intellectual property. These rights could affect the way education and learning develops in the future.

A Historical Review Of Technology And Human Development

Jean Piaget describes “behavior” as “All action directed by organisms toward the outside world in order to change conditions therein or to change their own situation in relation to these surroundings” (Piaget, 1978, p. ix). Actions or habits are determined by environmental circumstances that evolve within the framework of a process of global organization (Piaget 1978). Albert Bandura states that “people and their environments are reciprocal determinants of each other” (Bandura, 1977, p. viii). When studying the causes of human behavior, any condition or event which can be shown to have an effect on behavior must be taken into account (Skinner 1965).

Technology displays certain basic characteristics. It is the use of ideas to transform the material and nonmaterial world. Technology is behavioral in that the possession of skills is a form of behavior. Having tools implies the existence of skills in the creation and use of tools. There are organizational and institutional elements to technology because it requires organized group cooperation for successful implementation. As technology increases, the possible combinations and advances make technological change an accelerating process. Feedback

loops between the evolution of technology and the social process feed this acceleration. Technology is a problem-solving process. DeGregori says:

> By definition, all technology, if it is truly technology, is appropriate to some problem-solving endeavor. The selection of technology depends upon cultural, environmental, and economic criteria that define a problem and the characteristics of its solutions (DeGregori, 1985, p. 36).

Since technology involves behavior, is usually brings about cultural change (DeGregori 1985).

Technology has always been a part of human civilization and has had a role in its evolution. The wheel, spear, cooking, and every other advancement that has allowed humans to improve their condition are all examples of technology. Each advancement has allowed the society in which it was developed to achieve things that it was not able to achieve before (Temporary National Economic Committee (TNEC), 1999). A report by the Temporary National Economic Committee states:

> Technology refers to the use of physical things to attain results which human hands and bodies unaided are incapable of achieving. In this sense, technology reaches back to the beginnings of human culture, has

> always played a highly significant role in social evolution and will remain a mainstay of civilization (TNEC, 1999, p. 138).

To this point, technological advances are part of the natural development of humans and their societies. Advances in knowledge and technical understanding lead to the production and application of new technology which then causes changes in society (Norman 1981). Collin Norman describes it this way:

> Technology development, according to this view, is an evolutionary process, not unlike biological evolution. We even speak of new generations of computers, automobiles, and other high-technology goods as if they were biological descendents of earlier models, and key technical developments are often regarded as the progenitors of a whole range of subsequent innovations (Norman, 1981, p. 20)

Historically, many social changes have been determined by technology. The evolutionary process of technological change shares many similarities with the evolutionary process of life. It is a life-enhancing and life-enhancing process (DeGregori 1985). The introduction of technology changes the way society functions. “This concept lies

unstated behind such terms as the Bronze Age, the Machine Age, and the Computer Age" (Norman, 1981, p. 20).

Looking at the evolution of technology and idea that social change follows technological advancements, one can draw correlations between the development of agricultural technology and the rise of the cities in Sumeria as the land was able support more people. The development of steam power made the machines of the industrial revolution possible (Norman 1981). But, while Norman links technology and human development, DeGregori notes that distrust of new technologies is deeply rooted in Western culture. He says, "Some forms of resistance to new technology are endemic to the societal process of innovating technology" (DeGregori, 1985, p. 67). When one considers the institutional beliefs and practices associated with the developmental aspects of ideas, skills, and behavior, the resistance to change is inevitable (DeGregori 1985). This resistance is not an option for underdeveloped countries where the resistance to technologies that improve food production, sanitation, and education comes from the lack of economic means to achieve acquire them.

Like biological evolution, technical evolution is either nurtured or defeated by the forces surrounding it.

The ancient Greeks actually invented steam power (Norman 1981). Norman observes that:

> Technical evolution, like biological evolution, responds to a variety of forces. Biological evolution is driven by environmental pressures that favor the survivability of some species over others-insects resistant to an insecticide will swiftly predominate in a sprayed area, for example-and the key to the development of living things can be found only by looking at them in relation to their environment. Similarly, the key to technological development lies in the environment in which technological change takes place-in this case, the social, economic, political, and physical environment (Norman, 1981, p. 21).

The effect of the introduction of technology on a society is more dependent on that society's current environment and its willingness to nurture the change brought on by the technology. The technology itself is primarily dependent on the social and economic forces that control it. The Temporary National Economic Committee wrote the following about technological neutrality:

> Technology is relatively neutral; the more dynamic forces lie within the economic system that controls it. If this system is socially wholesome, its

> employment of technology will be socially advantageous; if it is less than this, its influence will be uneven-rendering benefits here, disadvantages there, as the prevailing cluster of conflicting economic forces may decide (TNEC, 1999, p. 139).

This neutrality is, however, challenged by some researchers. Janice Burn, of Edith Cowen University says:

> At times, it is difficult to grasp how supposedly neutral technology might lead to social upheavals, mass migrations of people, and shifts in wealth and power. Yet, a quick retrospective look at the past few centuries finds that various technologies have done just that, challenging the notion of the neutrality of technology. Some examples include the printing press, railways, and the telephone (Burn and Loch, 2001, p. 4).

These technologies alter the way people view time and space. Automated language translation systems will someday allow this time-space continuum to become smaller as the need for a common natural language diminishes (Lehman-Wilzig 2001).

Sometimes the introduction of technology does not yield the expected results. Given the capitalistic force behind many technological implementations, the ultimate

goal of the project is to improve productivity and/or reduce cost. Stakeholders analyze facts to predict outcomes and set expectations. Even though predictive analysis is done prior to implementation, external factors can cause unpredictable results or adverse side effects in other areas. One example involves the introduction of tractors to farmers in Pakistan.

In the late sixties, the government of Pakistan secured a loan for $43 million from the World Bank to import 18,000 large tractors. Large landowners were given the opportunity to purchase these tractors on very attractive credit terms. The farmers who purchased these tractors were able to increase their production as well as their incomes. A study in the early seventies revealed some unexpected results (Norman 1981).

The tractors allowed the farmers to cultivate larger areas than the oxen they had used before. This allowed the average farmer to double the size of their farm. This forced many small farmers off their land, and reduced the amount of labor hired by the large farmers. It was found that each tractor resulted in the loss of five jobs. The tractors were introduced to increase agricultural production, but in actuality the tractors were found to have no effect on crop yields or on the number of crops

grown. It was found that the distribution of the benefits from this program had been biased in a way that was actually socially regressive due to the loss of jobs, the loss of land by small farmers, and the lack of increased crop production (Norman 1981).

Even though technology is problem-solving, it is not the elimination of problems. When technology is introduced, old problems are solved, and new ones are created. The processes of social and technical evolution are not perfect. DeGregori says:

> Technological progress can be understood to have occurred if the problems created by technology are less harmful to the human enterprise than those solved (DeGregori, 1985, p. 152).

Current Trends In Information Technology And Human Development

Technology, especially the evolution of the desktop supercomputer, has accelerated end extended the reach of electronic information, especially in the scientific community. Engineers have developed systems that solve real problems producing commercial benefit (Derra 1999). However, the introduction of information technology is

subject to the same issues seen in history. Joe McDonagh, of the University of Ireland says:

> Outcomes from IT investment initiatives all too frequently fail to deliver much promised business value. Indeed, many organizations appear to experience significant underperformance and failure with regard to their IT investments as opposed to the promise of superior performance so frequently claimed in the business press (McDonagh, 2001, p. 11).

He cites examples of fiascos at The California Department of Motor Vehicles, Hilton Hotels Corporation, FoxMeyer Drugs, and Dow Chemical. He also suggests that the percentage of initiatives that deliver business value may be as low as ten percent (McDonagh 2001).

The participants in a technological implementation must approach the endeavor as problem-solving. Approaching a project in this way sets the tone in which issues of human development are addressed. It assigns values to the resolution of problems. DeGregori says:

> Problem solving involves people-choosing, an endeavor that is valuational. There is clearly a definable process by which reasonable, knowledgeable people select the correct tool to solve a mechanical problem. Questions of taste hardly matter in the determination

> of the size of wrench that one uses (DeGregori, 1985, p. 149).

In a business setting, a business case or cost-benefit analysis can be used as the foundation for approaching technological implementations in this way. In dealing with the cultural issues associated with organizational change efforts, it must be clear that technology and technological values do not destroy cultural values. Instead, they provide the means for finding new ways of expressing these values. These issues involve problems associated with the physical environment and cultural perceptions and definitions (DeGregori 1985). DeGregori cites this example:

> A preference for fatty foods is not subject to any external test as long as there are no known consequences for that preference. When knowledge of nutrition allows a casual judgment to be made—that consumption of such foods beyond some minimum is life-threatening—then technological valuations become relevant (DeGregori, 1985, p. 149).

In this example, continued consumption of fatty foods is, in a way, a display of ignorance.

Many IT enabled change initiatives fail to consider a number or human and organizational factors. These factors include; lack of business and technology strategies, lack

of attention to organizational structure and management style, lack of attention to education and training, and lack of attention to users' capabilities of cognitive style, stress adaptation, and motivational commitment (McDonagh 2001). In some instances, new ways of developing and delivering training have been developed using subject matter experts, instead of educators, to teach more technical topics (Williams 2001). In his conclusion, McDonagh summarizes the dilemma this way:

> The dilemma is of an enduring nature, sustained by behavioral patterns or polarized occupational groups who have vested, but divergent, interests in exploiting IT. Executive management tends to view the introduction of IT as an economic imperative while IT specialists tend to view it as a technical imperative. The coalescent nature of these two imperatives is such that human and organizational considerations are regularly marginalized and ignored during the process of introducing IT into work organizations (McDonagh, 2001, p. 17).

Equilibrium between these factors will tend to improve the outcomes of technology implementations.

It is not always easy to translate technological valuations into institutional practice. The customs and

culture that govern behavior do not always defer to the demands of new situations (DeGregori 1985). In many cases, institutional adjustments must be made to manage technologies. Some of these management techniques limit freedoms for the common good. Degregori cites a transportation-related example:

> If we have automobiles and airplanes, we must have systems of traffic control. Control, by definition, limits freedom; if instrumental and effective, it confers the more meaningful freedom to go safely from one place to another (DeGregori, 1985, p. 155).

In this case, it is perceived that the value of improving safe transportation is worth the cost of the freedoms loss through the implementation of the controls needed to keep it safe.

Sometimes the lack of access to technology, outside the business environment is a factor. Rural, low income, and central city minorities have less access to technology, such as the internet, putting them at a disadvantage during technology introductions (Burn and Loch 2001). Ford Motor Corporation and Delta Airlines are among the companies that are addressing this situation by equipping employees with home computers and internet access (Leonard 2000). This policy has the potential for enormous benefits and pitfalls

for the workers. Burnout is a risk as additional work hours are self-imposed and affect the work/life balance. Questions of additional compensation for after-hours training and work arise. Team members are affected by after-hours meetings called by leaders working from home in different time zones. This new knowledge-based economy poses new legal, social, and environmental challenges for industry (Leonard 2000). In some industries, there is shift from scientific and technology based innovation processes to new processes and technology for the creation of knowledge (Strambach 2002).

It is clear that attention to the learning and behavioral aspects of human development must be addressed for successful technology implementations. However these aspects must be addressed equally from the different perspectives of the stakeholders involved. In the past, projects, were parceled out to individual technical staffs and assembled later by managers into a final product. Today, hierarchical structures are being replaced with teams of different people from different disciplines called heterarchies. In this new structure, the leader is not determined by position, but who has the appropriate knowledge at each point in the process (Maccoby 2000).

Fragmentation exists in the nature of IT knowledge. This exists in both industry and academia. In academia, computer science departments do not consider business knowledge as core to their curriculum and therefore fail to give appropriate consideration to the human and organizational aspects of IT. Conversely, business schools take a "black box" view of the IT related aspects. Practitioners of organization development may best be positioned to bridge this gap (Coghlan and McDonagh 2001).

Future Trends In Information Technology And Human Development

Ray Kurzweil, inventor and high-tech entrepreneur has looked at the potential future merging of man and machine. He theorizes how the evolution of computers will have an impact on long term and the very long term human development in the twenty-first century (Kurzweil 1999). He theorizes that, by 2009, the hardware capacity of supercomputers will match the capacity of the human brain at 20 million billion calculations per second. Portable computers will be embedded in clothing and jewelry. He describes the interaction of these future computers this way:

> People typically have at least a dozen computers on and around their bodies, which are networked using "body LANs" (Local area networks). These computers provide communication facilities similar to cellular phones, pagers, and web surfers; monitor body functions; provide automated identity (to conduct financial transactions and allow entry to secured areas); provide directions for navigation; and perform a variety of other services (Kurzweil, 1999, p. 16).

In this mode, most communication, entertainment, and education is accessed through wireless technology. By 2019 most workers spend the majority of their time acquiring new skills and knowledge. Medical and sexual interactions are handled through virtual reality. By 2029 virtual teaching techniques make society an ever-learning environment, and most communications between humans involves machines. Life expectancy reaches 120 years (Kurzweil 1999). Mr. Kurzweil describes a view of a future that is possible. If human and technical development progress in this direction, the affects on society will be dramatic.

Irving Kristol, co-editor of *The Public Interest*, addresses problems with the place of science and technology in a liberal society. The Greeks and Chinese developed technology that was never applied in their societies. This

may have occurred because slave labor was cheap and the advancements were not necessary for the development of their societies. Another explanation is that the application of technology translates into power which can be used for good and evil. Theoretically, the ancients may have decided that they did not want to entrust this power with man and systematically discouraged the development of technology (Kristol 2001).

In today's environment, information is freely exchanged. College chemistry and physics majors possess the knowledge to create atomic weapons. In forty to fifty years, most people will know how to make some kind of explosive (Kristol 2001). As society copes with these developments, the basic premise of the liberal society will be challenged and scrutinized. Kristol emphasizes the need to educate scientists in humanities. He says:

> Scientists and engineers, on the other hand, have the inclination to think that the world is full of "problems" to which they should seek "solutions". But the world isn't full of problems; the world is full of people. That's not a problem. That's a condition (Kristol, 2001, p. 50).

He believes scientists should think of improving themselves instead of improving the rest of the world (Kristol 2001).

The internet has brought easy access to information to many households. Over half of higher income households in the United States have internet access (Burn and Loch 2001). Tools are being developed to organize and present information in more meaningful ways. Information visualization tools merge technologies in human-computer interaction and large database storage and retrieval (Hawkins 1999). These new technologies communicate the structure of the information retrieved. This has the potential to change how students do research because the searcher receives a visual overview of information relationships. This overview allows the user to comprehend and assimilate the information easier than a simple list of references (Hawkins 1999). These visualization tools now make it possible to actively link documents together with graphs so that the user sees the context of the information before the information is presented (Gaines and Shaw 1999). Human resource development professionals are beginning to see a change in the way employees are trained. Classroom instruction is down while efforts in the area of learning technologies are up (Dilworth 2001).

As information access methods improve and computing devices become more ubiquitous, human development could become more focused on learning. Currently, access to

computers and the internet are factors that confine this development to higher income members of developed societies (Burn and Loch 2001). Kurzweil's vision for the future of human development is dependent on the constant, easy access to computing devices (Kurzweil 1999). He envisioned dozens of computers integrated into clothing and jewelry. Today's technology is moving toward computational appliances. These appliances include such devices as the Palm series of handheld computers and SoftBook electronic book systems (Fishkin, Gujar et al. 2000). As human development moves more to a virtual orientation of how we think of thinks like turning pages in a book, the more ingrained electronical technology will be integrated into our lives. As people become more acquainted with concepts like context-sensitive information maps, they will become more comfortable with interacting with computing devices on a more physical and portable level. The standard keyboard and mouse will increasingly become more cumbersome. K. P. Fishkin, a senior software engineer at Softbook Press, Incorporated, describes research on this transition this way:

> Conveying the basic paradigm will be necessary just as users needed to understand the conceptual foundation for GUI interfaces. Once users understood the basic

> paradigm, they immediately began to explore the range of interaction. Just as GUI users try to find out what is clickable, our users tried a variety of manipulations on the prototypes to explore the space of detectable manipulations (Fishkin, Gujar et al., 2000, p. 80).

The interaction paradigm involves designing devices with more physical sensors. The perceptual user interfaces of the future will interact with humans in more natural and cognitive ways than the keyboard and mouse of today (Turk and George 2000). This will widen the range of possible physical manipulations and allow for a more natural user interaction (Fishkin, Gujar et al. 2000).

Computing appliances and databases are changing the world of business. Electronic commerce has given way to e-business. Using the internet as a communications medium, information can be bought and sold without producing anything more that electronic bits and bytes. Not only are the products transacted electronic, but the information about the transaction and the customer is stored electronically and has value. A recent article in *The Business Lawyer* says:

> As a result of their growing size and sophistication, and because of the pivotal role they play in managing

> business relationships, customer databases are becoming an ever more valuable asset for both “bricks and mortar” and Internet businesses (Winn and Wrathall, 2000, p. 214).

Recent advances in data mining and customer profiling have given businesses who master these capabilities a competitive advantage (Winn and Wrathall 2000).

These shifts in development have proven to be a challenge for the legal community. The commercial laws that govern business-to-business transactions and customer databases have not kept up with the pace of development in business practice (Winn and Wrathall 2000).

The future of technology in the classroom has some people in the academic community struggling with how to deal with new paradigms in learning. Unique reading strategies are needed for the World Wide Web (Sutherland-Smith 2002). Teaching techniques must develop to include new skills for accessing and analyzing information using computers as the medium for delivery. Web literacy is the term used to describe the new skill of finding, scanning, digesting, and storing internet information. Sutherland-Smith describes it this way:

> Web literacy demands an incorporation of key reading or navigation skills. These include accessing

> information, analyzing information (including multimedia), and processing procedures to store or move text. While these skills appear to be the same as those used with print text, academic writers tend to agree that Web literacy involves expanding critical reading skills to incorporate evaluation of visual and nontextual features and a greater use of associative logic (Sutherland-Smith, 2002, p. 663).

Use of the tools associated with electronic media must become as second nature as turning a page in a book.

Conclusion

Humans, as well as other life forms have been forced to exist within limits. These limits are a result of the physical environment that defines and or surrounds them. The human desire to overcome those limiting factors has resulted in the development of humans.

Technology, by definition, is a problem-solving process. It is an attempt, by humans to affect a change on their environment. Technological developments build on each other to continually change the human experience. Stages in human development are often referred to by the primary technology of the era.

Introductions of technologies are often resisted by the culture of the environment in which they are being introduced. The natural tendency of humans is to resist the social changes and controls often required to regulate new technology for the common good. Technologies often benefit a majority at the expense of a minority.

Many technology introductions are impeded by problems. Many times, attention is not paid to important educational, social, economic, and cultural issues. Failure to think through these issues often lessens the realization of expected benefits. In some cases, the problems created by new technology are greater than the problems solved by it.

Information technology has had and will continue to have a dramatic effect on human development. As computing devices and appliances become more ubiquitous, the potential exists for them to solve problems and enhance the ability for humans to change the environment around them. As the process of human development takes its course and technology is built upon technology, the potential for information technology to build upon information produced and assimilated by the technology itself is staggering. The potential for knowledge acquisition and dissemination is already beginning to revolutionize the learning process.

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RUNNING HEADER: Human Development

SBSF 8232 - KAM 2 Application

Professional Practice and Organizational Change

Human Development and Technology

Walden University

Mark T. Luckett

Ph.D. in Applied Management and Decision Science

Organizational Change Management

First Assessor: Prof. Earl Joseph

Faculty Mentor: Prof. Earl Joseph

December 6, 2002

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Introduction

Technological advances are part of the natural development of humans and their societies. Advances in knowledge and technical understanding lead to the production and application of new technology which then causes changes in society (Norman 1981). The theory of social learning assumes that “people and their environments are reciprocal determinants of each other” (Bandura 1977) p. vii). Behavior results from the interactions of persons and situations. Persons and situations are independent entities that combine to produce behavior (Bandura 1977). Bandura says “personal and environmental factors do not function as independent determinants, rather they determine each other” (Bandura 1977) p. 9). He goes on to state that “The relative influences exerted by these interdependent factors differ in various settings and for different behaviors” (Bandura 1977) p. 10).

Many IT enabled change initiatives fail to consider a number or human and organizational factors. These factors include; lack of business and technology strategies, lack of attention to organizational structure and management style, lack of attention to education and training, and

lack of attention to users' capabilities of cognitive style, stress adaptation, and motivational commitment (McDonagh 2001).

Sometimes the lack of access to technology, outside the business environment is a factor. Rural, low income, and central city minorities have less access to technology, such as the internet, putting them at a disadvantage during technology introductions (Burn and Loch 2001). Ford Motor Corporation and Delta Airlines are among the companies that are addressing this situation by equipping employees with home computers and internet access (Leonard 2000).

The internet has brought easy access to information to many households. Over half of higher income households in the United States have internet access (Burn and Loch 2001). Tools are being developed to organize and present information in more meaningful ways. Information visualization tools merge technologies in human-computer interaction and large database storage and retrieval (Hawkins 1999).

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The future of technology in the classroom has some people in the academic community struggling with how to deal with new paradigms in learning. Unique reading strategies are needed for the World Wide Web (Sutherland-Smith 2002). Teaching techniques must develop to include new skills for accessing and analyzing information using computers as the medium for delivery. Web literacy is the term used to describe the new skill of finding, scanning, digesting, and storing internet information. Sutherland-Smith describes it this way:

> Web literacy demands an incorporation of key reading or navigation skills. These include accessing information, analyzing information (including multimedia), and processing procedures to store or move text. While these skills appear to be the same as those used with print text, academic writers tend to agree that Web literacy involves expanding critical reading skills to incorporate evaluation of visual and nontextual features and a greater use of associative logic (Sutherland-Smith 2002)P. 663).

Use of the tools associated with electronic media must become as second nature as turning a page in a book.

Brian Cambourne, of the University of Wollongong in Australia, discusses the cultural relevance and importance of video games (Cambourne 2002). He cites the work of James Gee at the Center for Expansion of Language and Thinking Rejuvenation Conference when he states:

1. Thousands of people spend billions of dollars and devote millions of hours of their waking time each year deeply engaged in video games, especially those that allow them to create worlds (e.g., The Sims).
2. This activity entails learning and mastering some extremely complex conceptual systems, abstract ideas, ways of thinking and knowing, and then applying what's been learned to solve a range of complex problems.
3. For such complex learning, knowing, and problem solving to occur, such games must be based on an extremely powerful theory of learning and knowledge construction (Cambourne 2002) P. 759).

Video games are often very complex. Manuals are included with the games, but many times the player is left

to figure out some of the advanced functionality. Gamepro Magazine reviewed the game Dropship this way:

> There's a lot to remember: Hovering, flying, driving, shooting, and giving orders can be completely overwhelming – especially during heated battles. Also, the buttons can't be configured to your own liking, which can add to the frustration (Dragon 2002) , p. 74).

It is interesting to note that the complexities associated with playing these games are not taught in any class.

Some argue that video games lead to antisocial behavior in children. Parental abuse or neglect, however are more accurate predictors of youth violence and delinquency (Walling 2002). Recently, a lawsuit filed by a victim in the Columbine shootings was dismissed when a judges found that it lacked legal merit. In the suit, the plaintiff alleged that video game makers were liable for encouraging violent behavior in the killers who played them (2002). Contrary to popular opinion, there is little evidence linking video games to violent or antisocial behavior (Walling 2002).

Video games have been used for cognitive retraining in patients with head trauma injuries. Describing their use

in an outpatient setting, Bill Lynch, PhD, of Redwood City, California says:

> The original versions of such games as Pong, Breakout, Pac-Man, and Space Invaders were among the programs selected for use in retraining patients who exhibited problems with attention, concentration, visual scanning, and simultaneous processing. These games required the player/patient to manipulate an input device (either a circular dial or joystick) to control the movement, position, and speed of on-screen elements representing a ping-pong paddle, directional changer, or missile launcher. All four games called for quick reaction time, sustained attention, divided attention, visual tracking, target acquisition, and anticipation of effects of responses (Lynch 2002) P. 447).

A general improvement of cognitive and motor skills occurred in a subjects who were provided video games twice a week for a two month period (Lynch 2002).

Purpose

As companies deploy computer systems to solve business problems and improve efficiency, workers are required to

learn to use technology to perform more and more of their daily tasks. Workers are transitioning to knowledge workers. This requires new skills in knowledge acquisition and computer usage. People need to become as proficient at using a computer for knowledge acquisition and recording as they are using books, paper, and pens. Calculators are displaced by spreadsheets. Memos are replaced by electronic mail. Web searches and online help replace the use of reference books and manuals. All of this requires the worker to change the way he or she addresses tasks and problems.

Video game systems such as PlayStation, X-Box, Nintendo, Sega, and Atari require some of the same skills as the ones needed to master computer systems in the workplace. These video games require remembering long sequences of commands, abstract problem-solving, and hand-eye coordination. Many people have been exposed to these games as adults and during their developmental years. This exposure teaches fundamental computer skills that can be applied to the technology found in the modern workplace.

The purpose of this study is to analyze the effects of video games on workers' ability to use computer systems in the workplace.

This research identifies workers who use computer systems in the workplace. It compares computer users that have had exposure to video games and those that have not. The utilization of support services will be compared between the two groups. Also, some general attitudes and opinions about computer systems will be gathered.

The questions being researched are:

Do people who play video games require less support for the computer systems they use at work?

Hypothesis:

H0: Exposure to video games has no significance when predicting the number of times a computer user will make calls to technical support resources.

H1: Exposure to video games is significant when predicting the number of times a computer user will make calls to technical support resources.

Method

One hundred eighty five individual computer users in a US based Fortune 500 company were surveyed. Computer support technicians were interviewed to help identify

appropriate survey questions. A web-based survey tool called 2-Way was used to administer the survey electronically. This software package allows the user to conduct an anonymous survey over the internet. The results are recorded in a secured central database. The survey link was sent out via e-mail to registered computer users with e-mail accounts.

The survey contained questions designed to determine if the individual computer users had ever played video games regularly and if they were comfortable with the technology they used in the workplace. Of the 185 individuals surveyed, 144 responded for a response rate of 77.8%. Appendix 1 contains the survey.

Results

Table 1 contains a sample listing of the individual results for the survey. The first test analysis was done to determine the statistical significance of the descriptive variable change management on the dependent variables. A correlation table was used to do this test. Using a standard distribution of data, a significance factor of .05 or less is deemed significant for a given comparison of variables. Table 2 contains the results of these tests using the software package SPSS to do the

calculations. At .037, help calls and video games showed statistical significance.

Microsoft templates, included with the textbook Complete Business Statistics, were used to perform additional tests (Aczel 2002). Table 3 contains the results of these tests.

The descriptive variable videogame was compared to the six dependent variables. Correlation is considered at the .05 level or less in the two-tailed test. Age showed a significance of .067, which demonstrates low significance. The variable Helpcall showed a significance of .037, which demonstrates high significance. The variable Adqtrain showed a significance of .703, which demonstrates low significance. The variable Changein showed a significance of .868, which demonstrates low significance. The variable Chgtrain showed a significance of .135, which demonstrates low significance. The variable Fewrtech showed a significance of .199, which demonstrates low significance.

For the purposes of this paper, the secondary analysis was restricted to the Helpcall variable, since it was the only one that showed significance. A t-test for difference in population means was performed to compare how people with exposure to video games responded to the number of help calls they made versus the people without video game

exposure. The results of this test appear in table 3. With a confidence level of 95%, the null hypothesis is rejected. This indicates that exposure to video games is significant when predicting the number of times a computer user will call for technical support.

Discussion And Conclusion

This paper focuses on the effect that video game exposure has on the technical support needs of computer users in the workplace. The focus of the study discussed here is the number of times a computer user calls for a technical support person for help.

The survey results indicate a strong correlation between those persons who have not played video games and those persons with increased use of technical support resources. Attitudes toward changes in technology, requirements for training, processes involving the use of technology seem to be unaffected by a person's exposure to video games. It is interesting to note that 92.4% of the respondents indicated that they had personal computers in their homes and that exposure was found to be insignificant in predicting technical support use. It does not, however address the amount of support needed by the workers on

their home systems or the complexity of the applications used at home.

The results of this research suggest a strong correlation between video game usage and proficiency with business computer systems. Additional research might indicate what types of games improve computer proficiency. Also, additional study might reveal what factors correlate home computer use to the successful use of computers in the workplace. Also, a similar study, in another organization, should be done to verify the results presented here.

Table 1

	resultid	resultda	homecomp	videogam	age	helpcall	adqtrain	changein	chgtrain	fewrtech
1	1	05-NOV-2002	yes	yes	26-35	0	strongly	strongly	strongly	strongly
2	2	05-NOV-2002	yes	no	18-25	0	agree	agree	agree	agree
3	3	05-NOV-2002	yes	yes	36-45	3-5	agree	disagree	disagree	disagree
4	4	05-NOV-2002	yes	yes	36-45	0	agree	agree	agree	disagree
5	5	05-NOV-2002	yes	no	36-45	0	strongly	agree	agree	agree
6	6	05-NOV-2002	yes	yes	36-45	1-2	agree	agree	agree	strongly
7	7	05-NOV-2002	yes	no	56-65	0	agree	disagree	strongly	agree
8	8	05-NOV-2002	yes	no	36-45	0	agree	agree	disagree	disagree
9	9	05-NOV-2002	yes	no	36-45	0	agree	agree	agree	disagree
10	10	05-NOV-2002	yes	yes	26-35	1-2	strongly	agree	agree	not appli
11	11	05-NOV-2002	yes	no	46-55	1-2	strongly	disagree	strongly	disagree
12	12	05-NOV-2002	yes	no	46-55	0	disagree	agree	disagree	disagree
13	13	05-NOV-2002	yes	no	26-35	6-10	agree	disagree	disagree	disagree
14	14	05-NOV-2002	yes	yes	46-55	0	agree	agree	agree	disagree
15	15	05-NOV-2002	yes	yes	46-55	1-2	disagree	agree	disagree	disagree
16	16	05-NOV-2002	yes	yes	46-55	1-2	disagree	disagree	disagree	agree
17	17	05-NOV-2002	yes	no	46-55	0	disagree	disagree	agree	disagree
18	18	05-NOV-2002	yes	no	36-45	1-2	agree	agree	agree	strongly
19	19	05-NOV-2002	yes	no	46-55	0	agree	disagree	agree	disagree
20	20	05-NOV-2002	yes	yes	46-55	3-5	agree	agree	agree	disagree
21	21	05-NOV-2002	yes	no	36-45	1-2	disagree	disagree	disagree	disagree
22	22	05-NOV-2002	yes	no	36-45	1-2	strongly	agree	agree	disagree
23	23	05-NOV-2002	yes	yes	26-35	0	agree	disagree	agree	agree
24	24	05-NOV-2002	yes	no	26-35	0	strongly	agree	agree	disagree
25	25	05-NOV-2002	yes	no	36-45	0	agree	agree	agree	agree
26	26	05-NOV-2002	yes	no	46-55	1-2	agree	disagree	disagree	agree
27	27	05-NOV-2002	yes	yes	26-35	1-2	disagree	strongly	disagree	strongly
28	28	05-NOV-2002	yes	yes	36-45	1-2	agree	agree	disagree	strongly
29	29	05-NOV-2002	no	no	26-35	0	strongly	strongly	strongly	strongly
30	30	05-NOV-2002	yes	no	36-45	0	disagree	disagree	disagree	agree
31	31	05-NOV-2002	yes	yes	46-55	1-2	agree	agree	disagree	strongly
32	32	05-NOV-2002	yes	yes	46-55	0	agree	disagree	agree	agree
33	33	05-NOV-2002	yes	yes	26-35	1-2	agree	agree	agree	disagree
34	34	05-NOV-2002	yes	no	36-45	1-2	agree	agree	disagree	agree
35	35	05-NOV-2002	yes	yes	36-45	1-2	strongly	agree	agree	strongly
36	36	05-NOV-2002	yes	yes	36-45	0	agree	agree	disagree	disagree
37	37	05-NOV-2002	yes	yes	36-45	1-2	agree	agree	agree	not appli
38	38	05-NOV-2002	yes	no	36-45	0	agree	agree	agree	not appli
39	39	05-NOV-2002	yes	no	36-45	0	strongly	strongly	strongly	strongly
40	40	05-NOV-2002	yes	yes	46-55	1-2	disagree	disagree	disagree	disagree
41	41	05-NOV-2002	yes	no	36-45	0	agree	agree	agree	strongly
42	42	05-NOV-2002	yes	yes	46-55	0	agree	agree	agree	disagree
43	43	05-NOV-2002	yes	yes	36-45	3-5	agree	agree	agree	disagree
44	44	05-NOV-2002	yes	no	18-25	1-2	agree	agree	agree	disagree

Table 2

Basic Statistics from Raw Data — Help Calls Video = Yes

Measures of Central tendency

Mean	1.890625	Median	2	Mode	2

Measures of Dispersion

	If the data is of a			
	Sample	Population		
Variance	0.9561012	0.9411621	Range	4
St. Dev.	0.9778043	0.9701351	IQR	1

Higher Moments

	If the data is of a	
	Sample	Population
Skewness	1.3819217	1.3493197
(Relative) Kurtosis	2.0307703	1.7832413

Percentile and Percentile Rank Calculations

x	x-th Percentile	y	Percentile rank of y
50	2	2.0	39
80	2	2	39
90	3	3	84

Quartiles

1st Quartile	1		
Median	2	IQR	1
3rd Quartile	2		

Other Statistics

Sum	121
Size	64
Maximum	5
Minimum	1

Chebyshev's Theorem observation

Data points within	1.5	Std. Devns from mean	59
		out of	64
		which is	92.19%
		Minimum predicted by Chebyshev's Theorem	55.56%
		Minimum predicted by Empirical Rule	86.64%

Table 3

Basic Statistics from Raw Data — Help Calls Video = No

Measures of Central tendency

Mean	1.575	Median	1	Mode	1

Measures of Dispersion

	If the data is of a Sample	If the data is of a Population		
Variance	0.6778481	0.669375	Range	4
St. Dev.	0.8233153	0.8181534	IQR	1

Higher Moments

	If the data is of a Sample	If the data is of a Population
Skewness	1.7777167	1.7442093
(Relative) Kurtosis	3.8160328	3.5075939

Percentile and Percentile Rank Calculations

x	x-th Percentile	y	Percentile rank of y
50	1	1.0	0
80	2	2	58
90	2.1	2.1	90

Quartiles

1st Quartile	1		
Median	1	IQR	1
3rd Quartile	2		

Other Statistics

Sum	126
Size	80
Maximum	5
Minimum	1

Chebyshev's Theorem observation

Data points within	1.5	Std. Devns from mean	72
		out of	80
		which is	90.00%
		Minimum predicted by Chebyshev's Theorem	55.56%
		Minimum predicted by Empirical Rule	86.64%

Table 2

Correlations

Descriptive Statistics

	Mean	Std. Deviation	N
HOMECOMP	1.08	.27	144
VIDEOGAM	1.56	.50	144
AGE	3.08	1.00	144
HELPCALL	1.72	.91	144
ADQTRAIN	3.63	1.07	144
CHANGEIN	3.14	1.11	144
CHGTRAIN	3.09	1.10	144
FEWRTECH	2.33	1.16	144

Correlations

		HOMECOMP	VIDEOGAM	AGE	HELPCALL	ADQTRAIN	CHANGEIN	CHGTRAIN	FEWRTECH
HOMECOMP	Pearson Correlation	1.000	.205*	-.206*	-.054	-.072	.082	.048	-.104
	Sig. (2-tailed)	.	.014	.013	.520	.388	.330	.568	.215
	N	144	144	144	144	144	144	144	144
VIDEOGAM	Pearson Correlation	.205*	1.000	.153	-.174*	.032	-.014	.125	.108
	Sig. (2-tailed)	.014	.	.067	.037	.703	.868	.135	.199
	N	144	144	144	144	144	144	144	144
AGE	Pearson Correlation	-.206*	.153	1.000	-.022	-.242**	-.268**	-.224**	.057
	Sig. (2-tailed)	.013	.067	.	.792	.003	.001	.007	.497
	N	144	144	144	144	144	144	144	144
HELPCALL	Pearson Correlation	-.054	-.174*	-.022	1.000	-.109	-.051	-.150	-.037
	Sig. (2-tailed)	.520	.037	.792	.	.194	.546	.073	.656
	N	144	144	144	144	144	144	144	144
ADQTRAIN	Pearson Correlation	-.072	.032	-.242**	-.109	1.000	.372**	.583**	.075
	Sig. (2-tailed)	.388	.703	.003	.194	.	.000	.000	.371
	N	144	144	144	144	144	144	144	144
CHANGEIN	Pearson Correlation	.082	-.014	-.268**	-.051	.372**	1.000	.534**	-.046
	Sig. (2-tailed)	.330	.868	.001	.546	.000	.	.000	.582
	N	144	144	144	144	144	144	144	144
CHGTRAIN	Pearson Correlation	.048	.125	-.224**	-.150	.583**	.534**	1.000	.004
	Sig. (2-tailed)	.568	.135	.007	.073	.000	.000	.	.960
	N	144	144	144	144	144	144	144	144
FEWRTECH	Pearson Correlation	-.104	.108	.057	-.037	.075	-.046	.004	1.000
	Sig. (2-tailed)	.215	.199	.497	.656	.371	.582	.960	.
	N	144	144	144	144	144	144	144	144

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 3

t-test for difference in population means

Evidence

	Sample1	Sample2	
Size	64	80	*n*
Mean	1.89063	1.575	*x-bar*
Std. Deviation	0.9778	0.82332	*s*

Assumptions

Populations Normal

H_0: Population Variances Equal

F ratio	1.41049
p-value	0.1472

Assuming Population Variances are Equal

Pooled Variance	0.8013	s^2_p
Test Statistic	2.1025	*t*
df	142	

Null Hypothesis	*p*-value	At an α of 5%
H_0: $\mu_1 - \mu_2 = 0$	0.0373	Reject
H_0: $\mu_1 - \mu_2 >= 0$	0.9814	
H_0: $\mu_1 - \mu_2 <= 0$	0.0186	Reject

Confidence Interval for difference in Population Means

1 − α	Confidence Interval	
95%	0.31563 ± 0.29676	= [0.01886 , 0.61239]

Assuming Population Variances are Unequal

Test Statistic	2.06277	*t*
df	123	

Null Hypothesis	*p*-value	At an α of 5%
H_0: $\mu_1 - \mu_2 = 0$	0.0412	Reject
H_0: $\mu_1 - \mu_2 >= 0$	0.9794	
H_0: $\mu_1 - \mu_2 <= 0$	0.0206	Reject

Confidence Interval for difference in Population Means

1 − α	Confidence Interval	
95%	0.31563 ± 0.30287	= [0.01275 , 0.6185]

Appendix 1

Survey

This survey is intended to be filled out by computer users in a business environment. It is part of an academic study to determine the how technology in the home translates into technology usage in the workplace. It is a completely anonymous survey. All individual and company references are confidential and not tracked or disclosed. If you would like the results of this survey, please send an e-mail request to mluckett@waldenu.edu.

Do you have a personal computer at home?

Y N

Have you ever played video games such as Pong, Atari, Sega, Nintendo, PlayStation, X-Box, etc. regularly?

Y N

Please indicate your age range.

18 – 25

26 – 35

36 – 45

46 – 55

56 – 65

Over 65

On average, how many times per month do you call a helpdesk or local technical support person?

0

1 – 2

3 – 5

6 – 10

More than 10

Please use the following scale to answer the next four questions:

1. Strongly Disagree
2. Disagree
3. Not Applicable
4. Agree
5. Strongly Agree

1. I have had adequate training in the computer systems I use at work.

   1 2 3 4 5

2. Changes in the technology I use at work are made without incident.

   1 2 3 4 5

3. I am given adequate training when technology changes are made.

   1 2 3 4 5

4. Many of the process in my workplace would be more effective with the use of fewer technology tools.

   1 2 3 4 5

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