THE EVOLVING FACE OF STUDENT DISABILITY: A PROGRAM EVALUATION OF THE LIVESCRIBE ECHO PROGRAM AT HUMBOLDT STATE UNIVERSITY

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A Thesis Presented to

The Faculty of Humboldt State University

In Partial Fulfillment of the Requirements for the Degree

Master of Arts in Sociology

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May 2016

ABSTRACT

THE EVOLVING FACE OF STUDENT DISABILITY: A PROGRAM EVALUATION OF THE LIVESCRIBE ECHO PROGRAM AT HUMBOLDT STATE UNIVERSITY

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Disability services at the university level are an important aspect of higher education success for students with various forms of disability. Legislative and cultural changes over the past few decades have created an environment where the societal treatment of disability has moved from the medical to the social centric model. These changes have stimulated the growth and development of disability studies and disability services at the university level. A major skill needed to successfully achieve success in academia is that of notetaking, which is for some disabled students, a challenge. Adaptive technology, such as the LiveScribe Echo smartpen, has allowed university disability service departments to provide more options for enhancing the notetaking of disabled students. This research is centered on an evaluation of the LiveScribe Echo smartpen program currently offered through Humboldt State University's Student Disability Resource Center. Mixed methodology including training participant observation, trainer interviews, and an online survey of preexisting users was utilized to access the overall success of the program. The program evaluation was conducted across the measures of training, use of specific features, frequency of use, and student reported

academic skills improvement. Almost all students rated the program rather high in training, the technology and their related academic skills improvement and can thus be interpreted as the training program in specific and the entire program in general demonstrates a high rate of effectiveness.

ACKNOWLEDGEMENTS

I would first like to acknowledge the entire HSU Sociology grad program for providing me with the tools I would need to complete this thesis research. In hindsight, I can admit that I sometimes questioned the coursework's importance but now see that it all led up to my accumulation of skills that served me well during the creation of this thesis and I expect will continue to benefit me in my career objectives.

I would like to extend my gratitude to Kevin O'Brien (SDRC executive director), Kim Coughlin-Lamphear (SDRC office manager) and the entire LiveScribe Echo team for their giving me the opportunity to conduct my research on the LiveScribe Echo training program.

I would like to thank Dr. Mary Virnoche (thesis committee chair) for both her guidance and most of all her patience throughout this journey. Also, Dr. Renée Byrd (committee member-reader) for her insightful comments that allowed me to enhance the work presented here. I would be totally remiss if I did not acknowledge my graduate advisor Dr. Meredith Williams for all of her support throughout my graduate school experience. Her encouragement over the past two years has been valuable beyond measure.

The biggest thanks is given to my life partner, Robert Jones, for all of his support and patience during my grad school time. He was always there to listen when I needed to vent, when I questioned my ability to meet the demands placed upon me, and has never loss faith in me to achieve whatever goals I have set for myself.

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Evaluation Summary

A program evaluation was conducted in spring 2016 of the Humboldt State University (HSU) Student Disabilities Resource Center (SDRC) LiveScribe Echo smartpen program. Data was collected from 35 student clients (response rate 90%) and two trainers via mixed methodology consisting of training participant observation, trainer interviews, and an online survey of student clients. Student respondents more likely identified as female (76%) and white (60%) and reported a median age of 23. The analysis provides an assessment of the effectiveness of the SDRC training program, student experiences of the technology itself, and student perceived changes in academic experience and outcomes related to the program.

Almost all students rated highly the training, the technology and their related academic skills improvement. This evaluation was conducted by a graduate student as part of a master's thesis and in cooperation of the SDRC's LiveScribe Echo Team.

Key Findings

- Almost all students reported high use of the smartpen in class and in preparing for exams (97% and 82% respectively).

- More than three-fourths (77%) of students reported that their use of the LiveScribe Echo smartpen improved their understanding of material and their notetaking skills.
- Almost three-fourths (73%) of the students reported that they would consider, if financially able, purchasing their own smartpen in the future.
- Almost all (82%) students rated the training excellent to very good across measures of availability, time allotted for training, clarity, organization and adaptability.
- The training program was well organized. Information was presented clearly and delivery was adapted to client level of technological comfort and skill.
- The trainers exhibited very high levels of dedication to both the program and the students receiving the LiveScribe Echo accommodation.

Recommendations

- Enhance the training around LiveScribe Echo sticky notes and sound stickers. These features encourage direct engagement with text and related critical thinking skills.
- Consult with staff and faculty learning experts in designing sticky note and sound sticker training and explanations that might encourage students to use these features.
- Explore and evaluate the options for greater versatility in LiveScribe Echo smartpen use including tablet and smartphone interfaces.

- Validate respondent perceptions of improved academic success through assessment of grades before and after the introduction of the LiveScribe Echo smartpen.

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INTRODUCTION

A fundamental aspect of the human experience is that of learning as it begins to occur shortly after birth and continues throughout one's lifetime. For most, the subject of learning brings to mind the field of education and solid evidence suggests that higher education contributes to improved career potential which, in turn, may lead to a more satisfying financially successful life (Klinger, Moore, Berardi, Miller, Lukman, & Golverk 2014). Beyond the perhaps logical assumption regarding the potential individual monetary gains of higher education is the fact that an educated society is better suited to take on whatever challenges the future may present.

The pursuit of a higher education degree is for most one of the bigger endeavors they will face in their lifetimes. For people with disabilities, the attainment of the goal of higher education is often fraught with a compounded set of challenges stemming from physical or cognitive impairments. Statistics collected by the National Center for Education Statistics as recent as 2012 stated that 11% of undergraduates reported having some form of physical or cognitive disability (Digest of Education Statistics 2013). When considering that 1 in 10 students enrolled in American universities and colleges report having some form of impairment and virtually all academic programs are developed without consideration for the needs of this population, it is clear that a crisis of inclusion exists.

Humboldt State University (HSU), located in rural Northern California, has created the Student Resource Disability Center (SDRC) to take on the task of providing

accommodations and assistance to students with physical and/or cognitive impairments that impact their academic success. One of the tools utilized is the LiveScribe Echo smartpen to enhance the student note taking ability. The substantive core of this research is centered on an evaluation of this SDRC program as well as a review of literature regarding the societal progression of how disability is handled in the higher educational arena.

The LiveScribe Echo smartpen can perhaps be best described as ballpoint pen, infrared camera, microphone, and onboard speaker all rolled into one functional device with a goal of enhancing the note taking experience. The biggest advantage to this combination of features is that it allows for the simultaneous and synchronous recording of sound and handwriting. In line with this is the fact that the pen can replay the portion of the recording synced with the handwriting by simply touching the word or sketch with the pen. One caveat is the pen requires the use of proprietary 'dot paper' in order to be able to sync handwriting with audio capture of lectures or discussions. Another notable feature is that with the provided cable, the audio and notes can be downloaded from the pen into the LiveScribe Desktop application on a computer, which in turns allows for the organization and sharing of notes. The Desktop application provides for a more directed and comprehensive review of notes by use of the search feature that will highlight every instance of a particular word within the recording.

Since this discussion is centered on the LiveScribe Echo's use by SDRC, it is necessary to assess how this device is applicable for use with disabled students. One of the key features of this device is that it only takes a press of the pen onto the notebook to

not only begin a recording session but also to sync the audio with the handwriting. This allows for people with motor or cognitive impairments to simply make some identifiable mark in the notebook to signify importance of a particular aspect of the lecture. Additionally, the fact that it records the entire lecture regardless of handwritten notes affords for level of confidence and the subsequent ability to focus on the lecture and not worry about attaining complete written notes.

It is therefore not difficult to understand SDRC's selection of the LiveScribe Echo smartpen for use with students who may have difficulties with the taking of effective notes, arguably a keystone in the university educational process. That said the core component of this research is to conduct a program evaluation to evaluate, from the viewpoint of the currently enrolled students, the success and or failure of the LiveScribe Echo smartpen program in ameliorating the limitations brought about by disability.

REVIEW OF LITERATURE

Introduction

This research will start with a look at macro level societal shifts in regards to the handling of disability and progress to the micro level of postsecondary educational institution provision of assistance to disabled students. Further, as it is generally understood that the ability to synthesize and take effective notes is key to academic success (Makany, Kemp, and Itiel 2009), this research will pinpoint around the challenges of learning for those whose impairments impact the particular area of note taking. This will create a basis from which there will be an analysis of a current technology, LiveScribe smartpen, to determine if and to what extent it assists in the successful taking of effective notes.

Legislative Policies

Before delving into the area of political or legislative policies relevant to the current atmosphere of disability studies, it is important that it be mentioned the policies cited here are not the first enacted and only pertain geographically to the United States. That said The Rehabilitation Act of 1973 was enacted to deal with various areas of discrimination based on disability. It has been often referred to as the most substantial piece of legislation safeguarding the rights of individuals with disabilities. Specific to the arena of this research is Section 504, which makes it illegal for any federal agency, or

other private agency that receives federal financial assistance to discriminate on the basis of disability thus providing equal opportunities in the areas of employment, public accommodations and transportation, access to State and local government, and telecommunications. Furthermore, this section sets out specific regulations applicable to the respective agencies such as the U.S. Department of Education that is tasked to ensure that students with disabilities get the necessary educational services needed to succeed in school (Proctor 2001). In line with this is the basic fact that no educational facility associated with the federal government could refuse admission to any prospective applicant on the basis of disability.

Advancement in the protection of civil rights for individuals with disabilities came with the passage of the Americans with Disabilities Act of 1990. The notable aspect of this Act is that it expands the criteria of coverage beyond just federally funded agencies to include all employers (in organizations with 15 or more employees), public accommodations (i.e. hotels, restaurants, etc.), and all forms of public transportation. A key point of this Act is that it also provides a blueprint for acceptable accommodations such as width of sidewalks and angles of ramps intended for use by disabled individuals. Both of these legislative devices define disability in roughly the same way by stating that a person is disabled if they present a physical or mental impairment that substantially impacts a major life function, have an existing record of such impairment, or is regarded as having impairment (Miskovic and Gabel 2012).

In the interest in providing a more thorough analysis of legislative activity in regards to people with disabilities, it must be mentioned that the Individuals with

Disabilities Education Act of 2004 (IDEA) was enacted to ensure the availability of services for children with disabilities under the age of 21. This law is the governing force guiding how states and public agencies provide assistance such as early intervention programs and special education to eligible infants, toddlers, and youths with disabilities (Proctor 2001). Since this research is focused on postsecondary education and thus outside the realm of IDEA, the importance of this law within the context of this work is to introduce the concept that many students entering college may have already been exposed to federally mandated programs associated with disability. It is this atmosphere of disability awareness that has led to an ever-expanding access to postsecondary education and as such has resulted in the highest growth in admissions and subsequent graduation rates to include members of groups such as minority students, older students, and students with disabilities (Gregg & Hoy 1990).

Models of Disability

While the literature points to the existence of many models of disability, the research here will focus on the two more prominent models: the medical model and the social justice model. Creating a definition of disability is often rather contested and is most commonly viewed from the dichotomy between the medical model, which focuses on the individual, and the social model, which focuses on barriers that are socially created (Ohajunwa 2014).

Before delving into the differences and/or similarities between these two prominent models of disability, it should be noted that the literature indicates some variance in terminology. The medical model is sometimes referred to as the individual approach, which is understandable when considering that this model places disability firmly within the individual sphere (Linton 1998). The social model can be found in the literature as being referred to the social justice model, which based on this research hints at the fact that the social model is often seen through a distributive justice lens. Another terminology distinction vital to this research is the concepts of disability and impairments. Impairments are limitations of the physical body while disabilities are the result of socially created barriers (Shakespeare and Watson 2001). Another view into the impairment/disability terminology can be found in the International Classification of Impairments, Disability, and Handicaps (ICIDH) as proposed by the World Health Organization (WHO). According to this understanding, impairments are abnormalities in both structure and function of the body regardless if due to disease or trauma and disabilities are the limitations in the ability to execute tasks due to impairment. Finally, a handicap is the social disadvantage possibly associated with impairment (Bury 1996). It is this last set of definitions that creates an added challenge when reviewing the literature, as this distinction is not widely held but its implications are nonetheless important when examining this field of study. On the following page, table 1 offers a quick view of the differences between the medical and social models of disability so as to provide a framework before delving deeper.

Table 1: Disability Models Framework Comparison Typology

	Medical Model	Social Model
Identity	Flawed Individual	Whole Individual
Source of Barriers	Individual	Society
Reparations	Medical Profession	Societal Change

Medical model

Traditionally, disability has fallen under the domain of the medical establishment (Ohajunwa 2014). Disability scholars have suggested that most people have an understanding of disability that stems from the medical model of disability. The medical model of disability focuses on functional limitations associated to biological or mental states. That said the medical model is defined by four key definition components. The first sets up a disability as impairment based on a deviation of some kind from the species or biological norm. Secondly, such impairment restricts certain functions or personal abilities. Next, these constraints have a detrimental impact on well-being along with challenges in both social and economic outcomes. The last, and perhaps most notable, is the belief that the impairment must be dealt with via medical or other biological interventions (Barclay 2011). As this definition suggests, disability is for the most part a target of treatment and rehabilitation with an end goal of achieving some degree of normality (Terzi 2005). Furthermore, the acceptance of this model of disability keeps the issue firmly in purview of the medical establishment and consequently relieves society from examining its own processes that may lead to challenges for the lives of those with impairments (Linton 1998).

Social model

The social model of disability takes the opposite approach by locating disability squarely within society. In other words, disability is something imposed on disabled people by social and institutional structures that are oppressive and discriminatory (Terzi 2005). Thomas (2000) posits that the "inability of people with impairments to undertake social activities is a consequence of the erection of barriers by a non-disabled majority". Theoretically, the aim of the social model of disability is to redress both sources and causes of disability (individual and/or social) and to deny any theoretical validity to the concepts of normality and abnormality. Social model theorists consider the concept of normality as being an ideologically constructed mechanism by which disabled people could be excluded by mainstream social institutions (Terzi 2005). Accordingly, many theorists have taken the stand that the social model of disability is not only a more precise representation of disability but that is also uniquely positioned to validate the social changes and redistributive processes that would eliminate injustice (Barclay 2011). Thus, a required feature of the social model of disability is the eradication of discriminatory social practices and institutions that marginalize the disabled in favor of unbiased and inclusive institutions (Hartley 2011). Logically, it can be stated that this model allows for the institution-level analysis of the way in which disability is viewed from a societal aspect (Miskovic and Gabel 2012).

As stated previously in this review, the literature presents the social model and the social justice model to be essentially the same theoretical process. This is certainly a valid conclusion when considering the Constantine, Hage, Kindaichi & Bryant (2007)

definition of social justice as the "fundamental valuing of fairness and equality in resources, rights, and treatment for marginalized individuals … who do not share equal power in society because of their immigration, racial, ethnic, age, socioeconomic, religious heritage, physical ability, or sexual orientation status" (Kelsey and Smart 2012). Therefore, proponents of the social justice model assume that a clear imperative exists to modify aspects of society once the social aspect of disability is fully recognized (Barclay 2011).

Model interaction

While the theoretical constructs of both the medical and social models of disability clearly suggest a very diverse understanding of society's role in disability, a crucial fact is that one is reliant on the other when it comes to practical application. As detailed earlier in this review, the social model of disability posits that society is at fault and therefore must be changed. The problem arises in determining what and how to make changes in order to remove the barriers that disabled people experience. It is at this point that the social model is reliant on the medical model to gain an understanding of both the existence and possible remedies in regards to various forms of disability. From the practical standpoint and in the interest of tying this to higher education, the accommodations that can be made to assist in academic success are wholly dependent upon diagnosis from the medical model. In other words, individual flaw(s) must be determined before the social barriers can be addressed.

Disability and Academia

As mentioned earlier in this review, the early 1970's bore witness to legislative changes aimed at protecting disabled people from discrimination in many areas including education. A trend, commonly referred to as mainstreaming, began in the U.S. that actively included disabled students into the general population of students (Higbee, Katz, and Schultz 2011). This trend revealed significant social justice issues within the postsecondary educational structure. These concerns included the physical and institutional barriers that disable those with impairments as well as the policies and procedures that could be utilized to dismantle these barriers. Also, the university culture comes more into focus from the standpoint of how disability is represented or for that matter ignored. Beyond these concerns and perhaps of most importance is whether or not the university pedagogy or curriculum promotes or hinders the success of disabled students (Miskovic & Gabel 2012). These issues, along with the politicization of disability, led to the development of interdisciplinary enquiry regarded as disability studies rooted in the social justice model of disability along with other sociological insights. This field of study is often viewed as a "fusion between everyday struggles of disabled people…and the writings of disabled and non-disabled academics" (Barnes 2007). While a vast amount of literature presents disability studies as a reaction to policy changes, it should be understood that the study of disability did not develop in a vacuum but rather from decentralized inclusion in fields varying from psychiatry and psychology in the later part of the 1800's into the early 1900's to the inclusion of disability in social

problems and deviance courses within the field of sociology. It should be noted that each of these disciplines viewed disability from a nondisabled perspective (Taylor 2011).

Disability studies, much like the social model of disability, focuses on how disability is outlined and signified by society and is informed by many different disciplines such as history, literature, philosophy, economics, and cultural studies, to name a few (Taylor 2011). Finkelstein (1996) has identified three distinct perspectives within the realm of disability studies. The first is the 'inside out' approach, which posits that direct experience is an essential element towards gaining a complete understanding of disablement. This is a kin to a belief that only women can speak for women or blacks can speak for blacks. The concept of the personal is political is an accurate assertion when describing this approach. The second approach is that of the 'outside in' that moves away from the strictly personal and incorporates the understanding of non-disabled as to why barriers exist with an end goal of eliminating them. This approach is particularly important to disability studies at the university level as academics working within a framework of disability studies can offer logical and coherent analysis. Finkelstein's final approach, 'outside out', removes the personal and asserts that issues within the social world can only be accurately comprehended through the use of rational thought without the imposition of emotion or sentimentality. This approach also lends to the creation of value-free or impartial knowledge (Barnes 2007). Taylor (2011) states that disability studies have resulted in the enhancement of understanding the personal experiences to disabled students in a social and cultural context. Additionally, he posits that disability studies have, from a scholarly standpoint, "provided an intellectual lens

through which to examine everything ranging from cultural conceptions of beauty or normality to the social dynamics of stereotyping, discrimination, and exclusion" (Taylor 2011).

It is important to distinguish that disability studies is an academic area of study and thus not responsible for the practical service of assisting students with disabilities. The tasks of overseeing that disabled students are afforded the assistance needed for academic success falls to disability student service (DSS) providers. The staff in these areas of post-secondary institutions are tasked with providing quality service while 'juggling' the ever increasing number of disabled students, sometimes limited resources, complex accommodation needs all while adhering to legal mandates (Shaw and Dukes 2005). Another challenge they must also address is the increasing use of instructional technology while attempting to navigate the lack of faculty technical knowledge and skill necessary to provide equal access to students with disabilities (Fichten, Asuncion, Barile, Genereux, Fossey, Judd, Robillard, de Simone, and Wells 2001)

Adaptive Technology

The Individuals with Disabilities Education Act (IDEA) defines adaptive technology, also known as assistive technology, as "any piece or equipment or product system that is used to increase, maintain, or improve functional capabilities of individuals with disabilities" (Quenneville 2001). Assistive technology helps individuals with disabilities in two major ways, enhance strengths thus compensating for limitations due

to the effects of disability and provide an alternative approach to the performing of a task (Lewis 1998). The history of adaptive technology is rather large area of study thus for this research has been narrowed to its use within the realm of postsecondary education. The 1990s was the first decade that discussions concerning the use of adaptive technologies to assist students with disabilities attending postsecondary educational institutions. Toward the end of that decade, the discourse had shifted from the potential to the availability of assistive technologies (Fichten et al. 2014).

The term adaptive technology tends to bring the mind examples such as adjustable furniture to assist physically disabled or visual and audible assistive devices such as Braille typewriters or captioning services. In actuality, many forms of technology that are considered general use such as word processors, spell checkers, and dictation software have been instrumental in the educational advancement of students with disabilities. Tying this into the present research project, portable note taking devices, such as the LiveScribe smartpen, rank in the upper echelon of technology that students with disabilities consider as highly desirable (Fitchen, Asuncion, Barile, Fossey, and de Simone 2000). Digital pens, such as the LiveScribe, provide a critical support in regards to maximizing academic content engagement for both students with and without disabilities (Izzo and Bauer 2013). As the research suggests, the potential of adaptive technologies to ease frustration, enhance motivation resulting in increased assignment completion rates, and generate peer acceptance in the educational arena for disabled students is impressive (Quenneville 2001).

Note-Taking

Note taking is viewed as a complex activity requiring a level of comprehension and the ability to ascertain the importance of information (Piolat, Olive, and Kellogg 2005). This imperative function of academic instruction can be quite challenging thus it stands to reason that it may pose particularly difficult for students with either physical or cognitive impairments. The act of taking notes, especially during lectures, is arguably a vital component of academic literacy and success. Thus, note taking is considered a core classroom activity (Kim, Turner, Pérez-Quiñones 2009). The literature supports the idea that the act of taking notes may assist a student in achieving academic success because the simple process of taking notes aids in concentration and the physical aspect facilitates a kind of review process (Badger, White, Sutherland, and Haggis 2001). In fact, a study by Intons-Peterson and Fournier (1986) validated the position that the act of taking notes, regardless if reviewed at a later point, aids in the retention of the material presented (Kim et al. 2009).

An understanding of the importance of note taking requires inquiry into the process itself. Research into this area has focused on two hypothesizes, the encoding hypothesis and the external storage hypothesis, that suggest ways in which note taking can be beneficial to the learning process. The encoding hypothesis, also referred to as the process function, essentially posits that the processing of information either heard in a lecture or read enhances both learning and retention. The external storage premise, also denoted as the product function, touts the educational benefits of the ability to review

notes taken (even notes taken by someone else) (DiVesta & Gray 1973; Mueller and Oppenheimer 2014; Kiewra, Benton, Kim, Risch & Christensen). The research on the encoding process suggests that there are two forms of encoding, synthesizing and summarizing or verbatim transcription. Accordingly, the deeper processing of synthesizing information leads to greater encoding benefits and subsequently better performance in regard to educational outcomes (Mueller et al, 2014; Ward and Tatsukawa 2003). All of this is understood to occur in the working memory, which is defined by Baddeley (2010) as "system or systems that are assumed to be necessary in order to keep things in mind while performing complex tasks such as reasoning, comprehension, and learning". In sum, note taking is without much doubt is a complicated activity that involves the linking of comprehension and production processes (Piolat et al, 2005).

Conclusion

The intent of this research was to examine the social environment and subsequent changes in regards to the way disability is handled both from a macro level societal view and a micro level postsecondary educational institutional standpoint. This inquiry was conducted systematically by starting with the disability positive legislative changes followed by the way in which impairments are managed from socially inclusive standpoint. These changes gave rise to the field of disability studies culminating in the creation of disability service areas within the university structure that in turn contributed

to the increase in use of adaptive technologies. As the goal of this research was to evaluate the effectiveness of the LiveScribe smartpen, an adaptive technology utilized in note taking, the importance of note taking as part of the learning process was also assessed. The results of this research indicate clearly that discrimination on the basis of disability is no longer a preventative from attaining academic success and consequently prosperity in life.

METHODS

Introduction

The Student Disability Resource Center (SDRC) at Humboldt State University loans out the LiveScribe Echo smartpen and accompanying notebook to eligible students with documented physical or cognitive issues that impact their ability to take effective notes. The purpose of this research project was to conduct a program evaluation of the effectiveness of both the LiveScribe Echo smartpen and the training provided by SDRC. This investigation utilized a mixed methodology consisting of participant observation of the training program, trainer interviews and quantitative survey of students who have used the product for at least one semester.

My interest in this research is both personal and professional. I have a documented mobility issue that has provided me with a personal understanding of the necessity and advantages to possessing the ability adapt in a world constructed for the normally abled. As I progressed though my higher education, I have involved myself with the respective student disability services departments at the various institutions I have attended thus further enhancing my interest. My future career objectives center on some aspect of disability services in light of research such as that of the Institute on Disability at the University of New Hampshire that posits “if people with disabilities were a formally recognized minority group, they would be the largest minority group in the United States” (3).

This research project was developed by way of a meeting with the executive director of the Student Disability Resource Center (SDRC) at Humboldt State University in which potential research needs were discussed. While that discussion yielded several areas of interest, a study about the effectiveness of the LiveScribe Echo smartpen along with the training SDRC provides prevailed as a topic that offered the ability to expand my knowledge of disability services in a university setting. From this point, a discussion began regarding the best methodology to achieve the research goals. A decision to use a mixed methodology in data collection for this research project was informed by Dillman (2006) in which he posits "we cannot ignore the need to sometimes …mix them [survey modes] by collecting data by one mode, and the remaining data by another"(p. 12).

The logical starting point for data gathering would be to observe the SDRC offered LiveScribe training program. Participant observation method was selected based on a statement by Vidich (1955) in which "Participant observation enables the research worker to secure data within the mediums, symbols, and experiential worlds which have meaning to the respondents" (p. 354). The fact that I am a registered client of SDRC provided for a relatively seamless integration into the LiveScribe program thus making it possible for me to observe from the standpoint of the students who stand to benefit from the LiveScribe Echo training program.

Training Program

The direct evaluation of the training program was based on my participation in two training sessions and interview data collected from 2 trainers. In an effort to maximize the effectiveness of the LiveScribe Echo smartpen, SDRC has developed a training program staffed by five student SDRC employees. The decision to staff the program exclusively with students was informed by the desire to create a peer-to-peer environment in which the participants would feel that the trainers understand the demands of student academic life. The construct of the program will be provided as I detail the participant observation of my experiences with the training program.

Training Participant Observation

The process began by having to make a preliminary one-hour appointment at the SDRC's front desk adjacent to the Learning Center located in the Lower Library. At the time of the appointment, I was met by one of the members of the LiveScribe Team and was escorted to the LiveScribe training office located centrally within the offices that comprise the SDRC. I was first issued a LiveScribe Echo smartpen and accompanying notebook. The trainer asked several questions to assess my comfort level with technology before beginning to delve into the features of the device. After hands on demonstrations of the smartpen and notebook, the trainer proceeded to the desktop application portion of the training schedule. Customarily, the client receiving training is asked to bring their personal laptop to the first appointment. I did not bring my laptop with me so the training was modified in that ordinarily the trainer would assist in getting

the Echo desktop application loaded and setting it up on the client's laptop which requires the linking of the LiveScribe Echo smartpen to the client's laptop copy of the Echo desktop application. This setup consists of the input of a secured SDRC password which allows the specific smartpen to 'talk' to the client's copy of the Echo desktop application. Despite my lack of personal laptop, the trainer proceeded to demonstrate the features of the desktop application on the SDRC computer located in the office. The training appointment drew to a close with a period of time to allow me to ask any questions that were not addressed and to schedule a follow-up appointment for a week later so I would have some time to use the LiveScribe Echo smartpen.

One week later, I had my follow-up appointment with the same trainer as they prefer, when possible, to maintain continuity in the initial training. Similar to the first appointment, I checked in at the SDRC front desk and waited for the trainer. After being escorted to the LiveScribe training office, the trainer asked that I retrieve my laptop so it could be properly setup to allow the LiveScribe Echo smartpen I was assigned to work with my copy of the Echo desktop application. As it turned out, my laptop would not connect to the university's network thus making the setup not possible. The trainer informed me that this is not necessarily an unusual occurrence and was prepared to attempt to address the issue. When the trainer was unable to fix the issue, a call was made to the university's IT department suggesting that we bring the laptop to them so they could address the issue. The trainer accompanied me to the IT office that was a floor above the SDRC office. After the technical issues were addressed and we had returned to the LiveScribe training office, my laptop was fully setup to use the LiveScribe

Echo smartpen to its fullest potential. After spending some time with my copy of the Echo desktop application, the trainer asked if there were any other questions or concerns that needed to be addressed. The appointment ended with the trainer informing me that I could set up another appointment, via the front desk, anytime I felt there were issues in need of assistance. I was also informed that the LiveScribe team conducts a 'drop in' period every week which does not require any advance notice to address any questions or problems I may have with either the LiveScribe Echo smartpen, notebook, or Echo desktop software. The ethnographic field notes were subsequently coded inductively to develop a complete picture of the training process (Emerson, Fretz, and Shaw 2001).

Interviews

The participant observer aspect of my methodology provided insight into the training process that in turn informed the construction of my semi-structured interview question schedule (Appendix A). The nature and breadth of the question were informed by both the ethnographic observation of the training procedures and general qualitative question design (Weiss 1994). Unpacking the participant observer aspect in regards to the formation of the interview question schedule, by experiencing the training first hand, I was able to develop an understanding of the LiveScribe training team which allowed me to develop a framework from which the interview questions would be developed.

The recruitment of interview participants was guided by the recommendation of the SDRC's executive director in regards to trainers with the most experience working

with the LiveScribe Echo smartpen. One of the recommended candidates to be interviewed was the trainer from whom I had received my training. After our second training appointment was complete, we discussed scheduling for the interview and a determination was made due to scheduling conflicts, I would supply the questions via email and responses would be provided in a timely fashion. This method certainly affected the possible benefits of a semi-structured interview design but this was offset by the time spent with this trainer during our two appointments as some of the questions sought to develop an understanding of the individuals dedicated to the LiveScribe program. The interview responses were then coded using Dedoose qualitative analysis software along a framework to cultivate a clear understanding of the LiveScribe program.

After brief email communications, the in-person interview with another trainer was set up and conducted at the LiveScribe Team training office. The interview followed the same question schedule (Appendix A) as the email interview. The session lasted approximately 35 minutes and was audio recorded utilizing the LiveScribe Echo smartpen I had been assigned. The recording was later transcribed using ExpressScribe transcription software and coded similarly to the email interview responses.

Online Survey Sample

Since the overall purpose of the research was to gauge effectiveness of product and training, the population (39) consisted of only those who had previously been given access via SDRC to the LiveScribe Echo smartpen/notebook and experienced the training

program. The sample of respondents who actually completed the survey was 35. Table 2 illustrates the demographics of the survey respondents.

Table 2: Online Survey Demographics

Demographic	**Frequency**
Gender	
Female	76% (25)
Male	24% (8)
Race/Ethnicity	
Students of Color	40% (14)
White	60% (21)
Age	
Range	18 - 47
Median Age	23 years of age
Academic Major	
Arts, Humanities, & Social Sciences	40% (14)
Natural Resource Mngt & Science	40% (14)
Professional Studies	14% (5)
Academic Standing	
Freshmen	14% (5)
Sophomore	9% (3)
Junior	40% (14)
Senior	31% (11)

Online User Survey

The online survey instrument (appendix B) was designed via a combination of an existing survey framework provided by SDRC and knowledge gleaned from both my participant observation of the training and the interviews of the two most experienced student trainers. The central focal points of the survey were; client training experiences, frequency of use of specific features of the LiveScribe Echo smartpen, notebook, and

Echo desktop application, settings in which device was used, and academic effect of adoption of LiveScribe Echo smartpen.

Aside from several demographically based questions, the majority of the survey implemented the use of Likert scales. The determination to rely heavily on Likert scale questions was informed by the fact that data desired to evaluate the LiveScribe Echo smartpen and accompanying notebook relied heavily on client attitudes toward the various aspects of the entire LiveScribe Echo experience (Jamieson 2004). The LiveScribe team reviewed the survey instrument for any missing key components and suggestions were implemented accordingly. The survey was then entered on to the QuestionPro professional survey website for later administration.

Online Survey Administration

In meetings with both the LiveScribe team and the SDRC office manager, we determined that the best time to conduct the survey and get the highest possible response rate was at the beginning of the spring 2016 semester as the students were receiving their LiveScribe Echo smartpens and notebook in preparation for classes to commence. A laptop, provided by SDRC, was set up with a link to the survey and placed in the LiveScribe team office where appointments issuing LiveScribe Echo smartpen and notebooks were to be conducted. At each appointment, the returning student was asked if they had any questions or issues they would like to discuss regarding the use of the smartpen and desktop application. The trainer then proceeded to read a provided survey

script (Appendix C) in which they were asked to fill out a short survey and excused themselves from the office to retrieve the smartpen/notebook and complete paperwork regarding the signing out of the materials. The staff was instructed not to place any pressure on the student and to reiterate that the survey was anonymous and voluntary. The survey was conducted over a 3-week period from January 15 through February 8, 2016. A post survey debriefing appointment was conducted with the LiveScribe team to access if there were any issues regarding the survey period to which only one student reported technical issues. The data was retrieved from QuestionPro, constructed into a database and subsequently analyzed via SPSS.

FINDINGS

This survey focused on key aspects of the student experience with both the LiveScribe Echo Smartpen and the Student Disability Resource Center (SDRC) provided training program in regards to training, use of specific LiveScribe Echo smartpen features, general frequency of smartpen use, student reported academic skills improvement, and prior note taking experiences.

Training

The student responses to the question pertaining to their experiences regarding the training program were overwhelmingly positive with an across measures score of 82% rating the training program as excellent to very good. Table 3 illustrates that 86% of students surveyed rated trainer availability, the organization of training materials, and training clarity to be either excellent or very good. Also, the time provided for training and adaptability of both trainer and training program to meet the needs of specific cognitive or physical concerns scored either excellent or very good rating of 77%.

Table 3: LiveScribe Echo Training Program Evaluated as Excellent to Very Good

Training Measure	
Trainer Availability	86% (30)
Training Clarity	86% (30)
Organization of Training	86% (30)
Amount of Time Spent on Training	77% (27)
Adaptability of Training	77% (27)
Mean Training Score	**82%**

Use of Specific Features

The LiveScribe Echo smartpen has many integrated features to enhance the note taking experience. Students were asked to rate their use of these features from the perspective of use as either always or often. Note taking as a feature, the main purpose of the device, was reported as 100% while use of the accompanying computer Echo Desktop application which allows students to organize their notes scored 71%. This was followed closely by the listening of audio by way of the tapping of notes at 68% and the use of the smartpen to only record lectures without actually taking written notes at 53%. 41 percent of students responded that they supplement their note taking by using the search function within the Echo Desktop app. Both the audio playback only function and the use of the provided headphones earned an either always or often use score of 35%. Emailing of notes via Echo Desktop software, use of sticky notes, and the use of sound stickers presented a score of 15%, 12%, and 9% respectively. While the majority of these

features are self-explanatory, there are two that require some clarification. The sticky notes are essentially Post-it notes and the sound stickers are small circular stickers both including the required ‘dot matrix’ pattern required for audio and handwritten synchronization by the LiveScribe Echo smartpen. The stated goal of both of these two additional options is to allow note taking via application on handouts or within textbooks. Table 4 illustrates this data in order of descending use.

Table 4: Use of LiveScribe Echo Features Rated as Always or Often

Feature	
Notetaking	100% (34)
Echo Desktop Software	71% (24)
Listening to Audio via Tapping Notes	68%(23)
Use of Pen for Audio Recording Only	53% (18)
Use of Echo Desktop Search Function	41% (14)
Audio Playback Only	35% (12)
Use of Headphones	35% (12)
Emailing Notes via Echo Desktop Software	15% (5)
Use of Sticky Notes	12% (4)
Use of Sound Stickers	9% (3)

Frequency of LiveScribe Echo Smartpen Use

As important as what features are utilized is when and where students most frequently use the smartpen and Echo Desktop software. These results were also evaluated by combining the students who reported as always or often in regards to frequency of use. Student notetaking in the classroom reported in at 97% while 82% of

students responding stated that they used the smartpen during exam study time. 60% noted that they always or often use the Echo Desktop software to organize their notes. Working with other students, using the LiveScribe Echo smartpen to take notes at home and creating reports on the Echo Desktop software came in at 41%, 21%, and 21% respectively. This data is presented visually in table 5.

Table 5: Purposes and Frequency of Use of LiveScribe Echo Smartpen
Rated as Always or Often

Purpose of Use	
Notetaking in Class	97% (34)
Preparing for Exams	82% (28)
Organizing Notes on Echo Desktop Software	60% (20)
Working With Other Students	41% (14)
Notetaking at Home	21% (7)
Creating Reports on Echo Desktop Software	21% (7)

Student Reported Academic Skills Improvement

Beyond the LiveScribe Echo smartpen and its functionality is the impact that these features have on the academic skills of the student. All of students reporting stated that their understanding of the material being presented has either greatly improved or at least improved. Notetaking skills in general presented an improvement of 94% while organizational skill improvement was experienced by 79% of respondents. The meeting of deadlines, the level of class participation, and overall writing quality was noted as greatly improved or improved by 74%, 71%, and 56% respectively. 85 percent of

students conveyed that their grades had either improved or greatly improved. Table 6 presents this data in graphic form.

Table 6: Student Reported Academic Skills Improvement Rated
As Greatly Improved or Improved

Area of Self-Reported Improvement	
Understanding Material Presented	100% (34)
Notetaking Skills	94% (32)
Grades	85% (29)
Organizational Skills	79% (27)
Meeting of Deadlines	74% (25)
Level of Class Participation	71% (24)
Overall Writing Quality	56% (19)

Other Note Taking Services

Students were asked to specify what, if any, other note taking assistive services they have used in the past and the question was designed to allow for multiple responses to develop a thorough picture of previous notetaking experiences. At 39%, over a third reported that they did not previously utilize any form of notetaking assistive service. Audio recording was used by 27% of students reporting, while 6% stated they had used only assigned note takers. Almost one fourth of the students reported previously using some combination of assistive notetaking services and 3% stated they had used alternative note taking assistance in the form of access to a teacher's PowerPoint slides. This data is graphically represented in table 7.

Table 7: Classroom Notetaking Services Used Prior to Access to LiveScribe Echo Smartpen

Service	
None	39% (13)
Audio Recording	27% (9)
Assigned Note Taker & Audio Recording	12% (4)
Assigned Note Taker	6% (2)
Notetaking App & Audio Recording	6% (2)
Assigned Note Taker & Notetaking App	3% (1)
Assigned Note Taker, Notetaking App, & Other (listening device)	3% (1)
Other (access to teacher's PowerPoint slides)	3% (1)

Experience with LiveScribe Echo Smartpen

The students were presented with a question to gauge their overall attitude towards the use of the LiveScribe Echo smartpen by examining their perspective on ease of use. Nearly all, 97% (32) either strongly agreed or at least agreed that the smartpen was easy to learn and 94% (30) felt similar about the ease of use of the LiveScribe Echo smartpen's technological features. A final aspect of the experience question was to determine if their overall experiences with the LiveScribe Echo smartpen would result in a subsequent purchase for future use. Almost three quarters, 73% (24) reported that if they were financially able, they would purchase their own LiveScribe Echo smartpen. Table 8 provides a graphical representation of this data.

Table 8: Student Experience with LiveScribe Echo Smartpen Rated as Strongly Agree or Agree

Overall LiveScribe Echo Experience	
Ease of Learning Use of LiveScribe Echo	97% (32)
Ease of Use of Tech Features	94% (30)
Possible Future Purchase	73% (24)

Bivariate Analysis

The research data collected via the survey demonstrated little variability in that most student responses were generally high across all measures presented, thus looking for possible relationships in regards to user characteristics such as gender, race and previous technology exposure provided no substantive or statistically significant results. In addition, there were no relationships between the training measures and use of LiveScribe Echo features. An example of this is the observation that students who rated the training as poor subsequently reported high usage of LiveScribe Echo features along with improvements in academic skills. Likewise, there were students who rated the training as very good or excellent yet reported minimal use of the smartpen features as well as little or no improvement in academic skills. Table 9 provides a visual illustration by demonstrating that the rating in regards to satisfaction in training time had no significant effect on the use of the sound stickers feature.

Table 9: Effect of Training Time on Sound Sticker Usage

Use of Sound Stickers		
Training Time	Always/Often	Sometimes/Never
Excellent/Very Good	8%	92%
Average/Poor	14%	86%

Training Observation

As was detailed in my Methods section, part of my research methodology was to gain firsthand experience with both the SDRC provided training and the LiveScribe Echo smartpen. My training experience supports the high ratings in regards to the training assessment measures included in the survey instrument. Despite the fact that the trainer was aware that my participation in the training session was part of a research project, the training session appeared to be typical in both structure and content. This conclusion was supported by a later interview conducted with a different SDRC student LiveScribe Echo trainer.

LiveScribe Echo Smartpen Feature Use

The survey data collected regarding the use of particular features of the LiveScribe Echo smartpen illustrated that while there exists schools of thought on the most effective methods of note taking, ultimately it remains a personal methodology. The data supports this in that not a single student reported equal use of all features. However, there were two features in particular that showed little to no use and

thus would benefit from a more in depth analysis. Sticky notes and sound stickers are products offered by LiveScribe designed to enhance the note taking experience by offering adhesive backed small note size dot matrix paper to allow for use in textbooks or with flashcards, just to name a few of the possible uses. Both of these products were rated as low in use by a wide majority of student respondents. One possible explanation for this, based on my own experience, is the little amount of time spent during training covering these products. It is perhaps more likely that these low use numbers are symptomatic of something much larger than the training offered by SDRC. Note taking abilities are the culmination of years of schooling and thus often begin to form in elementary and high school years. Many of these young students are instructed not to write in or mark on their textbooks thus forming the mindset that textbooks are only for the purposes of being read and not for commenting or note taking. This is substantiated by my own experiences in the American public school system. A key aspect of both the sound stickers and sticky notes is to allow for the taking of notes in a textbook, thus it stands to reason that a mindset of not taking notes in a textbook would result in the low reported usage of products specifically designed for that purpose. The SDRC LiveScribe Echo training program is designed to assist the student in the use of the smartpen, notebook, and associated desktop computer application with the ultimate goal of minimizing physical and/or cognitive note taking impairments and not to educate on note taking technique.

Student Reported Academic Skills Improvement Analysis

The section of the survey in which students were asked to self-report improvements in academic skills presents data that is perhaps more valuable as a 'bigger picture' analysis than an item by item review. The positive increase across the measures regarding improvement speaks to an overall level in confidence gained via the reduction of note taking impairment and subsequent feelings of inclusion in class experience.

CONCLUSION

This research into the topic of disability and institutions of higher education began with a review of the literature that consisted of a look at the legislative changes that put into motion a change in how disability in general is handled. This led to an in-depth discussion on the two predominant models, medical and social justice, used to determine allocation of resources to help those deemed to have a disability. The changes in this area gave rise to the fields of disability studies and subsequently disability services to put into practice these advances. Adaptive technologies such as the LiveScribe Echo smartpen have become a valuable tool used by disability services in an effort to reduce the challenges faced by students with disabilities. The final key component discussed was that of the importance of note taking, the primary function of the LiveScribe Echo smartpen, in regards to the learning process.

The mixed methodology utilized in this research consisted of training participant observation in which I experienced the same training procedures as the student study participants. This was followed by a trainer interview and open-ended questionnaire. This data was then used to construct an online survey instrument tasked with assessing the effectiveness of both the LiveScribe Echo smartpen and the SDRC provided training program.

The resultant data provided that the training program was highly rated among measures of trainer availability, amount of training time allotted, organization and clarity of training materials and adaptability of trainers to specific disabilities. The findings of

the survey also provided a look at what specific LiveScribe Echo smartpen features were least used and thus could perhaps benefit from additional training time. Another interesting aspect of the findings pertained to the changes in academic skills from the standpoint of the student of which many reported overall improvement. Below I present key program assets along with recommendations for program enhancement.

Program Assets

- Dedicated office space to support both staff and clients.
- Devoted SDRC staff and enthusiastic student trainers.
- Training program well-structured to work with clients with various disabilities.
- Strong sense of support and belief in positive benefits achievable through the use of LiveScribe Echo smartpen on behalf of the student trainers.
- High percentage of clients (82%) rates the training program as very good/excellent.
- Strong percentage (77%) of clients report overall improved academic experience attributed to LiveScribe Echo smartpen use.

Recommendations

- Enhance the training around LiveScribe Echo sticky notes and sound stickers. These features encourage direct engagement with text and related critical thinking skills.
- Consult with staff and faculty learning experts in designing sticky note and sound sticker training and explanations that might encourage students to use these features.
- Explore and evaluate the options for greater versatility in LiveScribe Echo smartpen use including tablet and smartphone interfaces.
- Validate respondent perceptions of improved academic success through assessment of grades before and after the introduction of the LiveScribe Echo smartpen.

Future Direction of Study

Research delving into the effectiveness of university and college level disability services, such as Humboldt State University's SDRC, lends itself toward not only enhancing the knowledge base but also increasing the awareness of disability and the subsequent progress made towards creating a sense of inclusion for disabled students in the arena of higher education. One of the challenges of research in this area is the protection of the confidentiality of those with disabilities, which tends to place

restrictions on research measures. While use of student reported academic outcomes was a pivotal aspect of this research, further study might use other measures such as student interviews and focus groups to validate student perceptions of these academic outcomes. It is important to stress that the qualitative experiences of the students regarding their own academic experience are valuable resources in this nature of research.

The more that is known about the successes of these programs, the greater the likelihood that funding will be increased and program expansions will occur. Lastly, the importance of affording students with disabilities an opportunity to attain degrees of higher education cannot be overlooked, as their lifetime successes will ultimately benefit society in general.

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APPENDICES

Appendix A : LiveScribe Interview Guide

1. How did you learn to use LiveScribe?

2. What have you found to be the strengths and weakness of the technology in your own use?

3. How did you come to do trainings on LiveScribe for the SDRC? (When did you start?)

4. Can you tell me about the training model that you use at HSU (is there one? Where from? Typical flow of a training session?)

5. Have you changed your training approach since starting?

Ask them to start training you (observation and experience)

6. How long do trainings typically take? (Follow Up: variation because? Was my training typical?)

7. As you know, the SDRC works with students who have a range of disabilities. Are there particular groups of students who have a more difficult time with the technology?

(Follow Up: physical? cognitive?)

8. What do you think are the strengths of our training and support program for LiveScribe?

9. What kinds of recommendations do you have about potential changes to the LiveScribe training and support we provide at HSU?

10. What have I not asked you about that I should know in evaluating this technology?

Appendix B : LiveScribe Survey Instrument

Dear Student,

My name is Randy Prejean and I am a graduate student in Sociology at in Sociology Humboldt State University. As part of Master's thesis research, Student Disability Resource Center (SDRC) and I have teamed up to create a survey to assess the effectiveness of the LiveScribe Echo smartpen, as well as the provided training.

Your participation in this survey is strictly voluntary and confidential. This survey will be completed online using QuestionPro software. Features of the software allowing for the recording of IP addresses and emails will be disabled, providing anonymity. There are no risks associated with this survey: Your participation will not affect your access to SDRC resources.

This survey should take 10-15 minutes to complete. The data will be used to inform future SDRC decision-making and grant writing. Data collected from this survey will be retained for three years on a password-protected computer in the Department of Sociology, after which point the data will be destroyed.

As I will be the Primary Investigator, if you have any questions or concerns, please contact me at rjp392@humboldt.edu or at 925.212.8015. If you would like to speak with my research supervisor, please contact Mary Virnoche at mv23@humboldt.edu or 707.826.4569. You may also contact Kevin O'Brien at Kevin.OBrien@humboldt.edu or 707.826.4678.

If you have any concerns with this study, contact the Chair of the Institutional Review Board for the Protection of Human Subjects, Dr. Ethan Gahtan, at eg51@humboldt.edu or 707.826.4545. If

you have questions about your rights as a participant, report them to the Humboldt State University Dean of Research, Dr. Rhea Williamson, at Rhea.Williamson@humboldt.edu or 707.826.5169.

Please print this informed consent form now and retain it for your future reference.

1. I have read the above information and agree to voluntarily participate in this research.

_____ Yes
_____ No

2. How many semesters have you used a LiveScribe Echo smartpen? ____

3. Please rate the following aspects of the training program:

	Excellent	Very Good	Average	Poor	Very Poor
Availability of LiveScribe Echo smartpen tutors					
Amount of time provided for training					
Organization of training					
Clarity of information delivery					
Extent to which trainer could adapt training to my unique needs					

4. Indicate the frequency with which you use these LiveScribe Echo smartpen features.

	Always	Often	Sometimes	Seldom	Never
Note taking feature					
Audio recording feature (without using note taking)					
Sound stickers					
Listening to playback of recorded audio by tapping your notes					
Audio playback only (without accessing notes)					
Echo Desktop Software					
Echo Desktop Note Search Options					
Emailing Notes from Echo Desktop					
Sticky Notes					
Headphones					

5. Indicate the frequency with which you use the LiveScribe Echo smartpen in these settings.

	Always	Often	Sometimes	Seldom	Never
Note-taking in class					
Note-taking at home					
Preparing for exams					
During peer work					
Organizing notes on Echo Desktop					
Creating Reports on Echo Desktop					

6. What has been the effect of your adoption of the LiveScribe Echo smartpen on the following academic activities and outcomes?

	Greatly Improved	Improved	No Change	Worse	Much Worse
Note taking					
Understanding material					
Organization					
Participation in class					
Meeting deadlines					
Writing quality					
Grades					

7. Indicate your attitudes about your LiveScribe Echo smartpen experiences.

	Strongly Agree	Agree	Disagree	Strongly Disagree	Not Sure
The LiveScribe Echo smartpen is easy to learn.					
It is easy to use technological features of the LiveScribe Echo smartpen.					
After I graduate (assuming I have adequate funds) I am likely to buy my own smartpen					

8. Before using the LiveScribe Echo smartpen, which services did you use to assist you in the classroom? (Check all that apply)
__ Assigned note taker in classroom
__ Note taking application on my computer
__ Audio recording the lectures
__ None
Other:_____

9. What is your age?
_____

10. What is your gender?
_____ Male
_____ Female
_____ Other

11. What is your race/ethnicity? (Check all that apply)

_____ Asian / Pacific Islander
_____ Black or African American
_____ Hispanic or Latino
_____ Native American or American Indian
_____ White
_____ Other _____

12. What is your academic standing?

_____Freshman
_____Sophomore
_____Junior
_____Senior
_____Grad Student

13. How many semesters have you completed at HSU?

14. What is your major?
(I will not report outcomes by major. These will be aggregated into more general categories.)

_____

Thank you for time and input.

Appendix C : Trainer Survey Script

A graduate student in Sociology is helping us evaluate the LiveScribe Echo smartpen. He has designed an online survey that we have up on the laptop in the alcove. It would be great if you would complete the survey before we meet. While it's totally voluntary, it would be great if we could get your feedback. The survey is anonymous. If you don't want to do it... just click "no" on the first question and you are done. Please close the browser window when you are done.