

Running Head: KIHd USABILITY TESTING

Usability Testing on the Kellar Instructional Handheld Device

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## Usability Testing on the Kellar Instructional Handheld Device

Due to the mandates of No Child Left Behind (2002), and the re-authorization of the Individuals with Disabilities Education Act (IDEA) of 2004, the need for accountability with special education students has vastly increased. Assessments for these students should produce reliable and valid information that leads to student learning and improved instruction. Documentation of student improvement on Individualized Education Plan (IEP) goals through data collection and analysis might serve as one type of performance evidence (Heward, 2005). Therefore, efficient data collection and analysis tools are necessary to support school programs in documenting progress and making instructional decisions for students with disabilities. According to this need, the Kellar Instructional Handheld Data (KIHd) System, which provides input and output data, is currently being developed for teachers and parents to support their instructional strategies and to determine progress in learning activities.

The ultimate mission of the KIHd project is to create a data collection system for teachers and parents of children with special-needs to facilitate data-driven, educational decisions. The purpose of this research is for usability testing to determine the performance problems and identify areas in need of revisions for the KIHd prototype. In the fall of 2005, Immersion students working with the KIHd project conducted a performance analysis to determine the background of the problem. The Immersion team identified that teachers and parents are currently using the method of paper and pencil for collecting data. Furthermore, the KIHd Immersion team found this method to be so cumbersome that often the data is under analyzed or not analyzed at all.

This usability testing research will collect both quantitative and qualitative data to provide a greater understanding of the KIHd System and identify the potential home and classroom environments for further testing. The two sets of findings would be synthesized through a single discussion section.

KIHd System consists of two platforms, a Personal Digital Assistant (PDA) to primarily collect data and a Personal Computer (PC), which will mainly define and analyze the data collected. The data inputted to the PDA will be transmitted to the PC and stored into the Microsoft Access Database which can be accessed on the internet. The design team determined the use of Microsoft Access due to the availability in schools and homes.

When collecting data on the PDA, the teacher can “login” to the system; identify the student; select the domain, skill, and task; determine the data type, prompt level, and phase to begin the session. For example, Mrs. Jones can work with Johnny to collect discrete trial data on his knowledge of letter recognition. She would input her name, Johnny’s name, the domain of cognitive, the skill area of reading, the task of letter recognition of the letter A, determine the data type of frequency, prompt level of gesture and independent, and the treatment phase to begin her session. After the data has been collected, a graph will be displayed to analyze the child’s performance. The PDA has the ability to display the last ten sessions. This analysis tool is able to provide educators immediate feedback on the students’ performance.

The PC houses the KIHd System’s Administrative tool and a larger analysis component. Here the children’s learning goals based on their IEP can be defined. In addition, the graph in the PC can provide a visual analysis of student performance over

time. The PC also has the capability to visualize more than one child's performance. For instance, Mrs. Jones can see a graph of all her students' results on the letter recognition task.

### *Problem/Question*

The questions that need to be answered are: "Can the KIHD system be used to make data-driven decisions?"; "What modifications should be made to increase the usability of the KIHD system?"; and "What are the barriers of the current KIHD system?" The purpose of this study is to evaluate the KIHD system and look at some possible implication for future instructional technology for data collection.

### Literature Review

Children with disabilities are required by law to have a free appropriate public education which emphasizes special education and related services designed to meet their unique needs (Heward, 2005). Single subject design research is important to collect and analyze data to measure student progress, evaluate the effectiveness of the student's individual program, and to identify skills and/or behaviors that need to be taught. Exploration of practices for young children with autism found that the contributions of 27 single subject design studies from 1990-2002 were evaluated to support scientific evidence research to provide proof of the validity of the single subject design methodology (Odom, Brown, Frey, Karasu, Smith-Canter, & Strain, 2003).

In reviewing cost and effective intervention strategies, a methodology that works for the special education population, especially children with Autism is applied behavioral analysis or discrete trial training (Jacobson & Mulick, 2000). With applied behavioral analysis, the main practice breaks down learning into small components to

address learning deficiencies (Anderson, Avery, DiPietro, Edwards, & Christian, 1987; Birnbrauer & Leach, 1993; Fenske, Zalenski, Krantz, & McClanahan, 1985; Lovaas, 1987; McEachin, Smith, & Lovaas, 1993; Sheinkopf & Siegel, 1998).

### *Special Education Research Trends*

There is a dichotomy of thought concerning the quality of scientific research in the field of special education, especially related to the type of information that defines evidence (Odom, Brantlinger, Gersten, Horner, Thompson, & Harris, 2005). While the National Research Council (NRC) believes a variety of methodologies are required to address the diverse research questions, the What Works Clearinghouse (WWC), a synthesis organization, focuses on the “gold standard” consisting of randomized experimental group designs or randomized clinical trials (Shavelson & Towne, 2002). This philosophy is supported by the No Child Left Behind Act which compels educators to use “teaching practices that have been proven to work” (U.S. Department of Education, 2003).

### *Current Data Collection Practices*

The KIHd System would provide new technology to support the innovative practice of one-touch data collection whereby the data is collected and inputted at the same time. Current practices in the field of special education have the data collected and inputted separately into analysis programs. For example, Doug McElroy, (2005) conducted a seminar at the Council for Exceptional Children (CEC) conference entitled, “What to do with all these point sheets? Data-Driven Behavior Support.” He advocated for a specialized Microsoft Excel file to input data that had previously been collected. The collection time would take approximately fifty minutes a week. Once inputted into

the modified excel program, Behavior Feedback and Analysis Tool (BFAT), a chart would display the data for analysis. This methodology is currently being applied to 10 classes in the Springfield School District of Portland, Oregon (McElroy, 2005). The big issue is finding the time to input the data; the KIHd System would make this problem obsolete.

According to a workshop presented by Jennifer Austin in 2001, the graphing of discrete trial data could be accomplished with a great deal of training on the use of Microsoft Excel. Similarly, producing single subject design graphs using Microsoft Excel conforms to technical recommendations of a variety of publications (Carr & Burkholder, 1998). The KIHd system requires no training to chart each data point as this is accomplished by the program application and each chart produced already meets the recommendations of publication journals.

### *Current Perspectives*

Individuals that directly and indirectly impact the education of a child receiving special education in school include paraprofessionals, teachers, and principals. The purpose of this study will be to explore the ability of teacher and parent and their perspectives on how the KIHd system would assist in data collection, the ease of use, and understanding of the analysis tool or graph. There exists the need for a simple yet enhanced and comprehensive observational data collection and analysis system that supports the assessment of students with disabilities

In exploring data collection perceived barriers and the educators of paraprofessionals, teachers, and principals, the three factors that emerge are management issues, lack of time and skill of interpretation (Sandall, Schwartz, & Lacroix, 2004).

Programs for students with disabilities are highly structured; however these programs often rely heavily upon paraprofessionals, who have little or no training (Moshoyannis, Pickett, & Granick, 1999). A great deal of direct teaching on a day to day basis would be by the paraprofessional. Typically, these staff members have extensive responsibilities for teaching students with the most complex disabilities yet have the least amount of training (Giangreco, Halvorsen, Doyle, & Broer, 2004). While acknowledging the ever-growing role of the paraprofessional, districts may want to search for other alternatives for providing services to students. One possibility may be to monitor the work completed. A simple data collection system would help these individuals be held accountable for student performance.

The purpose of this study is to also describe and interpret the perspective of the participants. Looking at the rationale for factors in teacher beliefs about instructional choices, such topics arise as student related themes and teacher related themes. Some teacher related concepts include ideas like content and teacher efficacy (Flowerday & Schraw, 2000). With this in mind, for this study, it was important to also have qualitative data emerge on the usage of the KIHD System. This will serve to determine the user's mind-set in the evaluation of the system and aid in the design reconfigurations.

### *Single Subject Design*

Past research has investigated the power and use of statistical analysis with single-case designs (Barlow & Hersen, 1984; Ferron & Sentovich, 2002; Park, Marascuilo, & Gaylord-Ross, 1990). As such, the KIHD System would implement single subject designs. This is preferred when the focus is on individual analysis, when repeated

measurements of the dependent variable can be made, and when the researcher can also be the teacher of the participants (Talbot, Lloyd, & Tankersley, 1994).

The field of special education has used the single subject design to provide useful research information (Odom & Strain, 2002). Since the purpose of the single subject design is to document functional relationships between independent and dependent variables (Horner, Carr, Halle, McGee, Odom, & Wolery, 2005), the KIHd System potential study designs are as follows: AB design, ABA reversal design, AB multi-baseline design, ABA multi-baseline design, and ABC design. In addition, as noted, two KIHd System design options will be multi-baseline since the use of active baselines in single subject research is used to find the most effective interventions for individuals (Talbot et al., 1994). The KIHd System will be used with discrete trial learners such as children with Autism.

### *Hypotheses*

On the basis of the literature review, it is possible to hypothesize that the KIHd system will need more modifications before formal testing with the targeted population.

### *Method*

This study employed an explanatory mixed methods design. First the quantitative data was collected then the qualitative data to provide a more elaborate explanation of the results and to strengthen the conclusions of the study (Creswell, 2005).

### *Participants and Setting*

The study encompassed four steps: training video, discrete trial session, questionnaire, and interview. Eight individuals were tested, four parents of children with special needs and four teachers of children with special needs. All individuals had



experience and prior exposure to one-on-one discrete trial work and a variety of types of data collection. First, individuals began to get accustomed to the KIHD prototype by seeing a 15 minute training video created in Captiva by the Immersion team. Second, individuals were led to the video-taped testing area. Individuals were read the Usability Test Script, (see appendix A). The session was completed by asking and recording the answer to the question, “based upon this graph, what would be the next educational step for Adam?” Third, individuals were asked to complete the Likert scale questionnaire, (see appendix B). The fourth step was for individuals to finish a 15 minute in-person interview, (see appendix C). The entire testing period was conducted in about one hour.

#### *Data Collection*

Data was collected by using a Likert scale questionnaire and an in-person interview. One researcher was present for all participants across all steps of the study to ensure reliability of protocol.

#### *Analysis Methods to be Used*

The Likert scale questionnaire data was entered into the statistical analysis program SPSS. Descriptive analysis runs were conducted to include the mean, median, mode, standard deviation, range, minimum, and maximum. Video interviews were transcribed into manuscripts using Transania. Once the transcriptions were completed, the data was entered into NVIVO. The codes were completed by all five researchers in a group coding format for inter-rater reliability.

## Results

### *Overall Findings*

Overall the analysis of the KIHD System showed statically relevant percentages in the areas of usability, future usage, ease of collection, analysis, and educational decisions. In addition, the interview analysis resulted in the formation of the following categories: educational decisions, time, navigation, mistakes, terms, training, ease of use, and graph.

### *Quantitative Results*

The results showed that 75% of the participants felt the KIHD System was very easy or easy to use (see Figure 1), and would use the tool if they had the opportunity in the future (see Figure 2). Additionally, 75% of the participants rated the system very easy or easy to collect data (see Figure 3), for the analysis of that data (see Figure 4), and for making educational decisions (see Figure 5).

### *Qualitative Results*

Categories that emerge through the interviews were as follows: ease of use, mistakes, educational decisions, graph, terms, navigation-collection, and collecting data. Participants remarked 40 times about the graph and 30 times (see Chart 1) within the ease of use grouping. The quotes ranged from "...it was just right there and was very clear," (see List 1 ) to "...have the information instantaneously is very helpful" (see List 2).

## Discussion

### *Interpretations and Conclusions*

While the majority of participants were positive about the system, the areas of revisions have been identified as navigation concerns and term clarification. These results

show areas of the KIHD system that need improvement in design. Designation of those zones will dictate the identified areas of revision for the KIHD project.

The results demonstrated a qualitative and quantitative picture of the current KIHD prototype and will be a basis for future revisions. In addition, the frequency graph needed further explanation for the participant than in the original protocol. Based upon this feedback, the graph would need revisions of better labeling. Furthermore, significant training for teacher and parents would need to be developed before further testing is conducted.

### *Limitations*

The individual participants used the KIHD prototype for data collection of the scripted discrete trial session with Immersion team members. The actual prototype would eventually be used with special education children, who potentially may be less cooperative. In addition, the Commerce Lab represented a controlled environment while the actual usage of the prototype would be in the less structured environment of a classroom or home.

### *Importance*

Once modifications in design have been made, the KIHD system needs to be used in a classroom and home setting to begin to look at the evaluation of single subject intervention methodologies. A future study may also be to focus on a variation of Single Subject Design and across different special populations as well as across environments.

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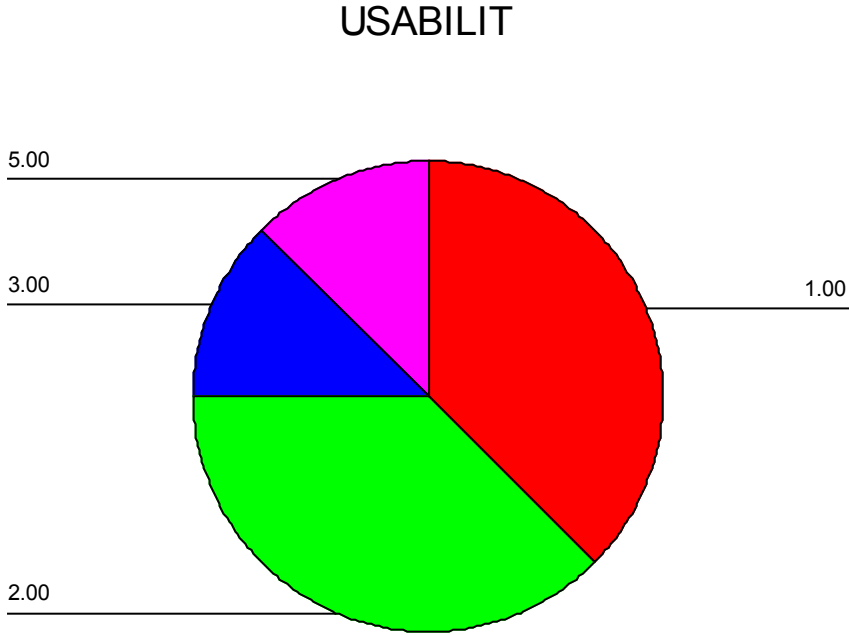


Figure 1. Usability

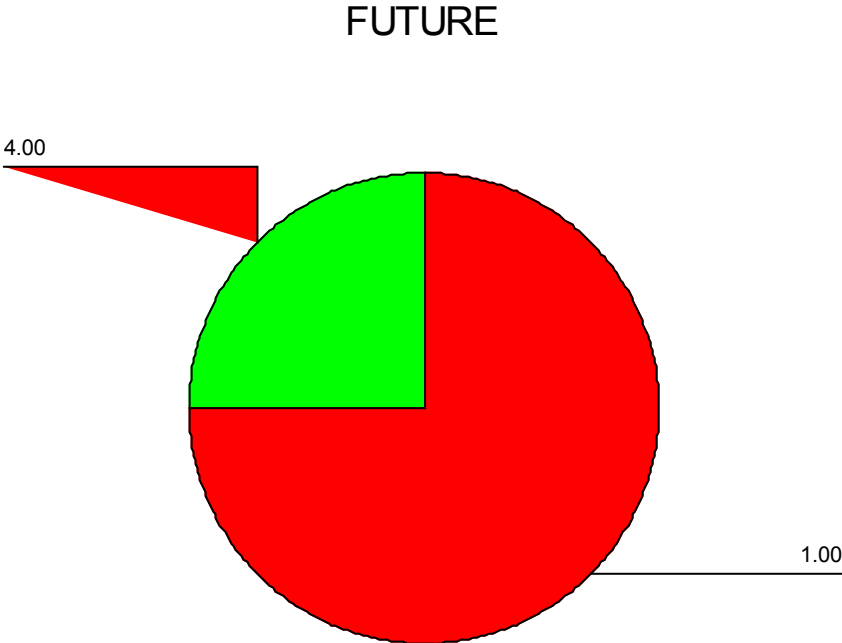


Figure 2. Future Usage

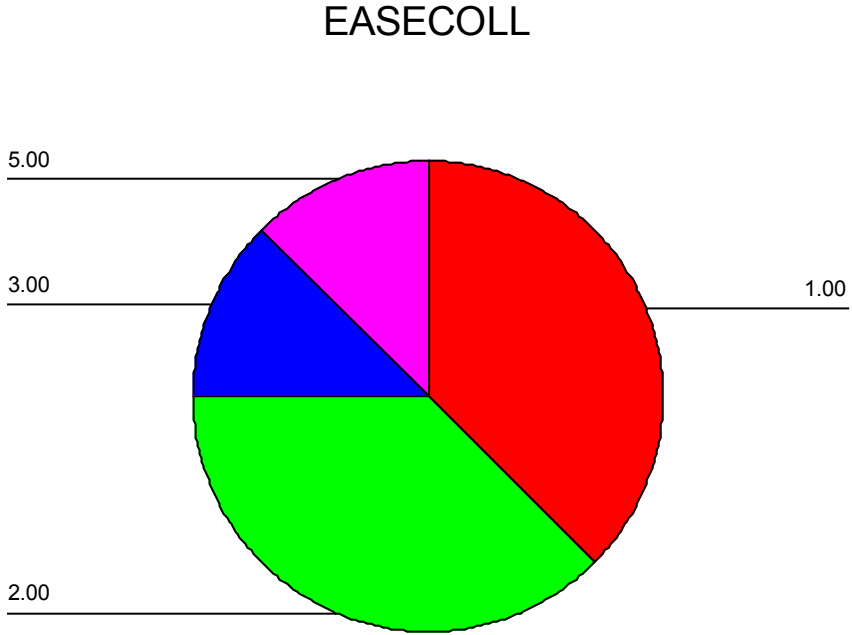


Figure 3. Ease of Collection

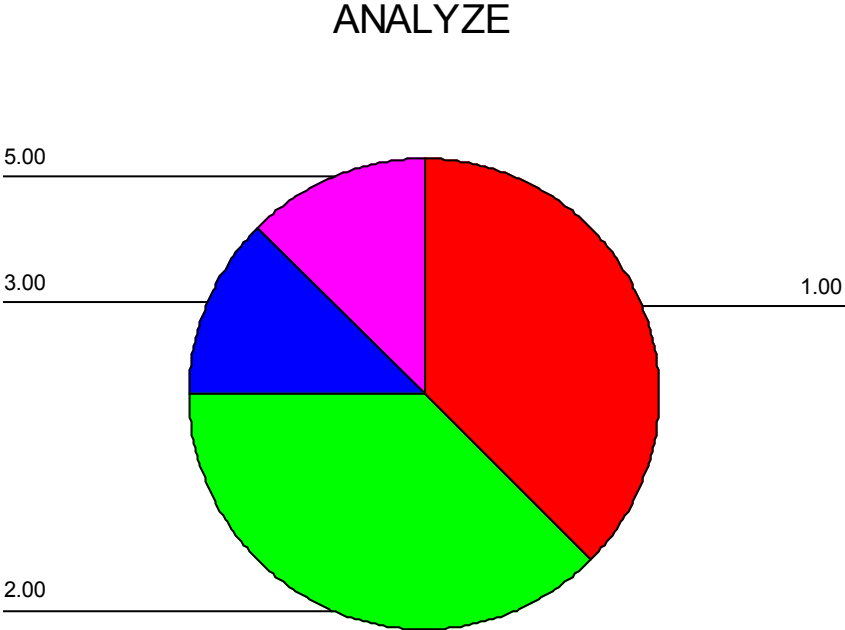


Figure 4. Use of the Graph for Analysis

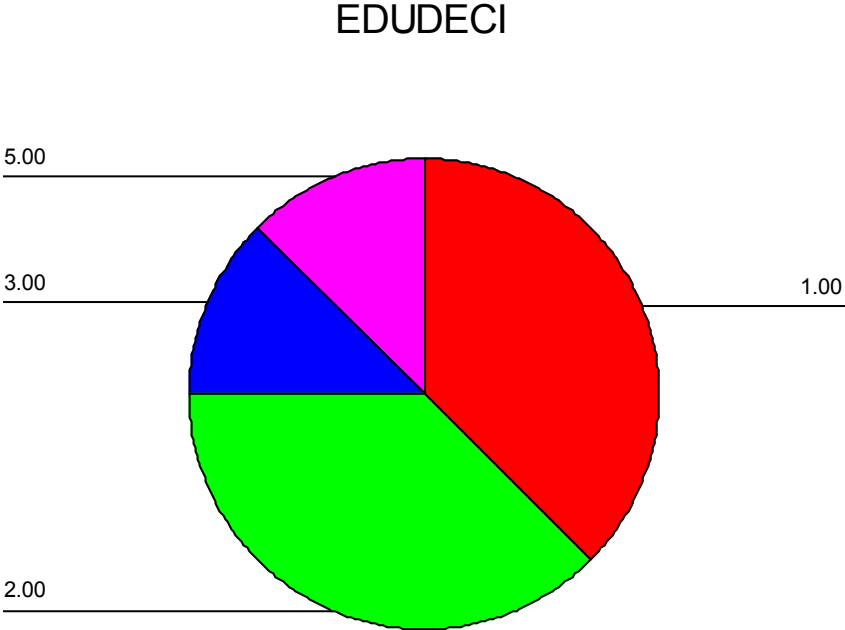


Figure 5. Using the KIHd System to Make Educational Decisions

Chart 1

Categories and Number of Times Coded

(A) /Ease of Use

(B) /Mistakes

(C) /Educational Decisions

(D) /Graph

(E) /Terms

(F) /Navigation~Collecting

(G) /Navigation~Collecting/Collecting Data totals

	A	B	C	D	E	F	G	Totals
NVivoalex	5	2	2	3	0	1	1	14
NVivochitra	2	1	8	6	1	2	0	20
NVivogeorgeanne	4	2	3	6	3	1	0	19
NVivojenny	6	3	1	4	3	1	0	18
NVivomarissa	3	6	3	3	3	2	0	20
NVivosarah	5	4	4	7	6	5	0	31
NVivosherri	2	2	2	8	1	3	0	18
NVivotracy	3	0	1	3	1	3	0	11
Totals	30	20	24	40	18	18	1	151

List 1

Node Coding Report for Ease of Use

NODE CODING REPORT

Node: /Ease of Use

Documents in Set: All Documents

Document 1 of 8 NVivoalex

Passage 1 of 5 Section 0, Para 7, 31 chars.

7: It was urprisingly easy to use.

Passage 2 of 5 Section 0, Para 7, 25 chars.

7: so similar to a computer.

Passage 3 of 5 Section 0, Para 11, 30 chars.

11: it was easy, it was very easy

Passage 4 of 5 Section 0, Para 15, 21 chars.

15: .it was pretty easy.

Passage 5 of 5 Section 0, Para 39, 53 chars.

39: easier to analyze data if you see through patterns.

Document 2 of 8 Nvivochitra

Passage 1 of 2 Section 0, Para 4, 21 chars.

4: it was a great system

Passage 2 of 2 Section 0, Para 10, 29 chars.

10: it was a breeze – no problems

Document 3 of 8 NvivoGeorgeanne

Passage 1 of 4 Section 0, Para 6, 50 chars.

6: I guess it was easy, easy to use. Usability of it

Passage 2 of 4 Section 0, Para 8, 46 chars.

8: it was also easy, because it was right there,

Passage 3 of 4 Section 0, Para 14, 25 chars.

14: and very user friendly.

Passage 4 of 4 Section 0, Para 32, 157 chars.

32: I think, it's really exciting, it's really neat. I would love to use it in the classroom. I think it would be really cool, it would be easy to keep data.

Document 4 of 8 NvivoJenny

Passage 1 of 6 Section 0, Para 6, 78 chars.

6: It's very easy to use the PDA, it's nice to handle that, it's very, very easy.

Passage 2 of 6 Section 0, Para 11, 33 chars.

11: It felt comfortable, enough yes.

Passage 3 of 6 Section 0, Para 13, 54 chars.

13: I like the way you could just tap the yes very easily.

Passage 4 of 6 Section 0, Para 13, 67 chars.

13: I thought that was a very good idea to just have one button to tap.

Passage 5 of 6 Section 0, Para 25, 34 chars.

25: easier than a pencil, much easier.

Passage 6 of 6 Section 0, Para 33, 194 chars.



33: We've tried to take data with our granddaughter you know, you are running around with a clip board and trying to do it and if you just had that there and tap, tap everytime it would be terrific.

Document 5 of 8 Nvivomarissa

Passage 1 of 3 Section 0, Para 3, 79 chars.

3: but the use of the PDA is very in my opinion for me...is very easy so I think

Passage 2 of 3 Section 0, Para 3, 36 chars.

3: I also think its very user friendly

Passage 3 of 3 Section 0, Para 7, 42 chars.

7: Very comfortable I mean easy very easy.

Document 6 of 8 Nvivosarah

Passage 1 of 5 Section 0, Para 11, 31 chars.

11: how easy it was to use overall.

Passage 2 of 5 Section 0, Para 11, 39 chars.

11: I felt like it was pretty easy to use.

Passage 3 of 5 Section 0, Para 15, 40 chars.

15: Enjoyable was it was really easy to use

Passage 4 of 5 Section 0, Para 15, 1 chars.

15:

Passage 5 of 5 Section 0, Para 24, 37 chars.

24: I was comfortable, very comfortable.

Document 7 of 8 Nvivosherri

Passage 1 of 2 Section 0, Para 22, 35 chars.

22: I mean it wasn't terribly difficult

Passage 2 of 2 Section 0, Para 26, 213 chars.

26: I see it being very helpful once a student's information is put into the system I imagine there must be some kind of print out I could get at some end and not have to reenter that kind of data over and over again.

Document 8 of 8 Nvivotracy

Passage 1 of 3 Section 0, Para 4, 72 chars.

4: I guess that it is all set up, the ease of use. Easy to pick up and use.

Passage 2 of 3 Section 0, Para 10, 16 chars.

10: very comfortable

Passage 3 of 3 Section 0, Para 12, 58 chars.

12: most helpful is that its all right there and easy to use.

List 2

Node Coding Report for Graph

NODE CODING REPORT

Node: /Graph

Documents in Set: All Documents

Document 1 of 8 NVivoalex

Passage 1 of 3 Section 0, Para 23, 46 chars.

23: most helpful was the graph, to instantly see.

Passage 2 of 3 Section 0, Para 31, 34 chars.

31: I would prefer a frequency chart.

Passage 3 of 3 Section 0, Para 43, 19 chars.

43: more graph options.

Document 2 of 8 NVivochitra

Passage 1 of 6 Section 0, Para 12, 30 chars.

12: the chart was the most helpful

Passage 2 of 6 Section 0, Para 12, 39 chars.

12: the chart was probably the most helpful

Passage 3 of 6 Section 0, Para 14, 33 chars.

14: i thought it was very beneficial.

Passage 4 of 6 Section 0, Para 16, 155 chars.

16: it had all of the information - it had the history which is what you need to determine acquisition of skills - it had everything for that particular skill.

Passage 5 of 6 Section 0, Para 21, 75 chars.

21: I would definitely use it - I used it today and I would definitely use it

Passage 6 of 6 Section 0, Para 23, 86 chars.

23: adding some kind of mechanism after the chart to tell you - ok what can you do next?

Document 3 of 8 NVivogeorgeanne

Passage 1 of 6 Section 0, Para 14, 46 chars.

14: oh I like the, the chart that comes up with it

Passage 2 of 6 Section 0, Para 22, 85 chars.

22: being able to have more time to maybe analyze it, it would be....it would be fabulous

Passage 3 of 6 Section 0, Para 26, 58 chars.

26: Yeah, ummm, I think even like a bar graph, would be nice.

Passage 4 of 6 Section 0, Para 30, 43 chars.

30: it's right in front of you, it very clear.

Passage 5 of 6 Section 0, Para 30, 113 chars.

30: I find with the data keeping that I currently do, I don't know, eh, eh, I really have to take time to analyze it.

Passage 6 of 6 Section 0, Para 30, 73 chars.

30: Here it's right there and it's right in front of you, it's very visual.

Document 4 of 8 NVivojenny

Passage 1 of 4 Section 0, Para 17, 98 chars.

17: I thought I was going to see every time I asked there would be a plotted point so that I could see

Passage 2 of 4 Section 0, Para 17, 72 chars.

17: I don't know if it would have been possible you would see that pattern.

Passage 3 of 4 Section 0, Para 21, 154 chars.

21: I think the line graph is fine. I don't think a bar chart or anything like that would... no I don't think so, I think it is a really good way to show it.

Passage 4 of 4 Section 0, Para 33, 114 chars.

33: you don't have to then go back and ummm, start plotting little points on a piece of paper. Excellent. Excellent.

Document 5 of 8 NVivomarissa

Passage 1 of 3 Section 0, Para 10, 91 chars.

10: yeah i`m sure that a bar graph or any other types of graph visualling would be helpful

Passage 2 of 3 Section 0, Para 11, 213 chars.

11: there won`t be errors in translating even if there were errors initially inputting the data there wouldn`t be errors in translating that into a graph format so that would be very nice because that happens a lot.

Passage 3 of 3 Section 0, Para 12, 250 chars.

12: I think I would emmm depending on you know what would be available to me if i was looking for something a little more complex or wanted to look at it from a different angle it would be nice if could take that same data and look at it in different

Document 6 of 8 NVivosarah

Passage 1 of 7 Section 0, Para 3, 57 chars.

3: I'm not really sure looking at the graph what it would be

Passage 2 of 7 Section 0, Para 15, 56 chars.

15: Plus it did the graph afterwards which was really great.

Passage 3 of 7 Section 0, Para 28, 17 chars.

28: I loved the chart

Passage 4 of 7 Section 0, Para 32, 38 chars.

32: I was a little thrown by the two lines,

Passage 5 of 7 Section 0, Para 32, 325 chars.

32: I was also surprised, my, I expected one of the lines to be high the whole time because all the responses given were correct. And the graph didn't show that. The graph showed it starting very, very, low and then going up high. So I'm not sure, but I guess that was probably because I input, I put some data in incorrectly.

Passage 6 of 7 Section 0, Para 36, 24 chars.

36: I guess broader graphs

Passage 7 of 7 Section 0, Para 36, 227 chars.

36: so that you would be able, by looking at the graphs, be able to say, that this particular child has a really high um a really high level on um in his expressive language ability but really low on his receptive language ability.

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Passage 1 of 8 Section 0, Para 5, 29 chars.

5: this graph is very confusing.

Passage 2 of 8 Section 0, Para 9, 16 chars.

9: How small it was

Passage 3 of 8 Section 0, Para 9, 61 chars.

9: I was surprised by the way the data was represented at the end

Passage 4 of 8 Section 0, Para 26, 64 chars.

26: The least helpful, I wasn't really fond fo the graph at the end.

Passage 5 of 8 Section 0, Para 30, 9 chars.

30: It didn't

Passage 6 of 8 Section 0, Para 34, 283 chars.

34: I couldn't tell at a glance you know, I mean I knew the student had gotten them all correct, but I didn't get that from the graph. so I am not sure it would be a bar chart as opposed to a line graph. I don't know. It just wasn't real obvious to me the way the data was represented.

Passage 7 of 8 Section 0, Para 42, 45 chars.

42: i didn't think the graphs were very accurate

Passage 8 of 8 Section 0, Para 42, 45 chars.

42: in general I could see it being very helpful.

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Passage 1 of 3 Section 0, Para 6, 193 chars.

6: When I looked at the graph i felt that adam had completed the work independently, and yeat the graph is basedon his previous trials and he did really well today compared to his previous trials.

Passage 2 of 3 Section 0, Para 12, 46 chars.

12: i am not totally sute I understood the graph.

Passage 3 of 3 Section 0, Para 18, 11 chars.

18: A bar graph