PSYCHOMETRICS OF LEVEL OF KNOWLEDGE USE SURVEY (LOKUS)

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INTRODUCTION

Despite efforts by the National Institute on Disability and Rehabilitation Research (NIDRR) to promote translation of its grantee research findings into innovative devices and services to benefit individuals with disabilities, uptake of new knowledge has been short of success in terms of speed and magnitude.[1] In responding to this situation, the Center on Knowledge Transfer for Technology Transfer (KT4TT) at the University at Buffalo is developing an intervention strategy to translate new knowledge from completed NIDRR grantee research, using a combination of contextualized knowledge package (CKP), training and technical assistance for use by relevant stakeholders.[1] In order to determine the effectiveness of this strategy, the Center on KT4TT has also developed a "Level of Knowledge Use Survey" (LOKUS) for identifying the level of knowledge use by relevant stakeholders. This instrument is designed for web-based administration. Before the use of LOKUS, it is important to establish its psychometric properties.

Purpose of the Study

The purpose of the current study was to establish the psychometrics for LOKUS in terms of: (1) test-retest reliability and (2) responsiveness. In addition, two tests were conducted: whether or not the level of use of new knowledge is developmental and whether responses to a web-based method are different from responses to the traditional paper-&-pencil method. This study focuses on new knowledge produced in the field of alternative and augmentative communication (AAC).

METHODS

Study Design

In order to identify content validity of the LOKUS, a survey method was used where four experts in the field of technology transfer rated each item. For establishing the other psychometrics, a randomized matched two-sample pretest-posttest design was used. The two samples consisted of participants who were presented the LOKUS by two different methods, one using the web based administration method through the survey tool *Vovici* and the other using a paper-&-pencil method. The two groups were matched in terms of educational levels. Measurements were taken at baseline (T1), 1 week later (T2), and at 4 weeks (T3). A simulated CKP based intervention took place between T2 and T3. At all 3 times, the survey briefly presented 3 published studies (A, B and C) in AAC, where A is the study for which the intervention had been prepared. Detailed information regarding the study was provided as intervention but not about the other 2 studies. The study design is shown in Figure 1, where R indicates random assignment, O is survey administration, and X is CKP intervention.

		T1 (1 wk)	T2	(3 wks)	T3
R (P &P)	A	O	O	X	O
	B	O	O		O
	C	O	O		O
R (Web)	A	O	O	X	O
	B	O	O		O
	C	O	O		O

Figure 1: Study Design

Participants

Sample size was determined using a pervious study, which identified a large effect size. To achieve a statistical power of .80 at α=.05, with the effect size, 64 participants were needed. Considering attrition, 72 were recruited for this study. However, at the end of the study period, there were 69. A consecutive sampling method was used to recruit participants. Inclusion criteria were college students, faculty members and clinicians who studied, worked, or are working in the field of AAC.

Instrument

Initially, the LOKUS was developed based on the level of use scale by Hall et al. (2006) for innovations [2]. It consisted of 9 levels of use, with 7 categories within each of the last 7 levels. This initial version had medium content validity as rated by three experts. Considerable revisions were made and the tool underwent the same procedure again, using four experts different from the first test. The average content validity was 68.2% of 100 for level. For category, it ranged 66.7% to 93.8%. Therefore, a second revision was made. Further, *face validity* was tested by seven experts with close to 100% agreement. After the third revision, the LOKUS was ready for use as an assessment tool in this study.

The LOKUS consists of 10 levels (Levels 0-9) and 3-6 categories under each level, but levels 0 and 1 have no categories. The levels are: (0) non-awareness (of new knowledge), (1) Awareness, (2) Orientation, (3) Preparation, (4) Initial use, (5) Routine use, (6) Expansion, (7) Collaboration, (8) Integration, and (9) Modification. The categories are: Being Aware, Getting information, Sharing, Assessing, Planning, and Implementing. The same format was used for all 3 studies presented in the tool. The study participants were asked to choose only one level, the response being dichotomous (yes or No). But they were allowed to choose more than one category. In addition, open-ended questions were placed at the end of the LOKUS and called for source of information and other comments.

Analytical Scheme

Face and Content validity was established based on ratings of four experts. It was considered sufficient if each item was rated good and very good for approval. More importance was placed on comments for ratings of poor and very poor, than on the average of ratings. For test-retest, since the scale was ordinal, Wilcoxon Singed Ranks tests comparing T1 and T2, and Spearman correlation were used for levels. For categories, since responses are dichotomous, McNemar Test for dependent sample and Spearman correlation were planned but since there were no eligible responses for this analysis, this was not performed. For comparisons, not significant results and for correlation, significant results were expected.

For responsiveness for levels, significant change between T1 and T3 was expected only for Study A, but not for Studies B and C. The change was recorded dichotomous (Presence and absence of change). Kruskal Wallis One-Way ANVOA was used to compare three studies with post-hoc procedure. If the participant's level stayed the same, categories within the level were expected to change, as measured by McNemar Test. However, as there were no eligible responses, this test was not performed.

To determine whether the levels are developmental or not, change of level by participant was examined. Among those who made a change in level, if the majority moved up to the next level, the levels were considered as developmental. For difference between the Web-based and paper–pencil methods, Mann-Whitney U-test was used for both dichotomous changes (Changed vs. Not changed) as well as for the number of levels changed.

Comments were analyzed using content analysis. PASW 18.0 was used for all statistical analyses, setting the significance level at .05.

RESULTS

Participants' Demographic Characteristics

Participants who used a paper & pencil method had more experience in the AAC field by about 5 years, but due to a large standard deviation, the difference was statistically not significant. Age, gender, and education were similar in both methods. Table 1 summarizes

major demographic characteristics of participants.

Face Validity

Face validity was established by three experts with 100% agreement on appropriateness of levels and sufficiency of categories.

Table 1: Demographic Characteristics

Variable	Paper & Pencil (n=35)	Web-based (n=34)	Difference
Age	26.6 (6.4)	25.2 (7.0)	t=.757 (p=.452)
AAC experience (in months)	26 (26.6)	21.2 (18.3)	t=.880 (p=.382)
Gender			X^2 =1.292 (p=.256)
M	9 (25.7%)	5 (14.7%)	
F	26 (74.3%)	29 (85.3%)	
Education			X^2 =1.003 (p=.793)
<BS/BA	7 (20.0%)	7 (20.6%)	
BS/BA	10 (28.6%)	11 (32.4%)	
MS/MA	15 (42.9%)	15 (44.1%)	
Doctorate	3 (8.6%)	1 (2.9%)	

Test-Retest Reliability

The results of comparison between T1 and T2 were identical for level and category. The correlation coefficient was 1.0 for all studies for both test-taking methods. Therefore, excellent test-rest reliability was established for both level and category.

Responsiveness

Study A was used as a treatment and Study B and C were control. As shown in the 2nd column of Table 2, for Study A, 90.5% of participants changed their level of use of knowledge while 11.6% for Study B and 14.5% for Study C. The Kruskal Wallis One-Way ANOVA was significant at p<.001, and the multiple comparison analysis identified no difference between Study B and C and significant difference (p<.001) between Study A versus Studies B and C. Therefore, excellent responsiveness (i.e., detection of change) was established for level. The change was greater than the measurement error.

Regarding categories, it was assumed that after exposure to an intervention, if participants stayed at the same level, their use of new knowledge would vary in categories in the level. However, four people who stayed in the same level were either at level 0 or 1; therefore, there were no eligible responses to analyze.

Table 2: Change in levels of use of new knowledge

Study and Method	Change made between T1 and T3	Difference between the two methods
	Frequency (%)	***Dichotomous (Changed vs. Not) Number of levels p-level***
Study A		
Total	65/69 (90.5%)	.038
Paper & pencil	35/35 (100%)	.194
Web-based	30/34 (88.3%)	
Study B		
Total	8/69 (11.6%)	.147
Paper & pencil	6/35 (17.1%)	.125
Web-based	2/34 (5.9%)	
Study C		
Total	10/69 (14.5%)	.961
Paper & pencil	5/35 (14.3%)	.100
Web-based	5/34 (14.7%)	

Developmental Levels

In order to identify whether levels are developmental or not, change was examined among participants who made changes. Table 3 summarizes the number of participants who changed their levels from T1 (Column 1) to T3 (other columns). As Table 3 shows, the majority moved up only one level. At T3, 66 of 207 moved up in level, where 40 (58.0%) moved up 1 level, 22 (31.9%) moved up 2 levels, 4 (5.8%) moved up 3 or more levels. No one moved down. Only participants in lower levels (0 or 1) moved more than one level. Therefore, levels appear to be developmental.

Difference between the Two Methods

The difference between the two methods was identified by examining the change from T1 and T3. When participants were identified using a dichotomous scale (Changed vs. Not Changed), significant difference (p=.038) was found for Study A, but not for Studies B and C. When the difference was examined using an ordinal score, no statistical significance was present in any of the studies. As summarized in the third column of Table 2, a web-based method tends to have more people who did not change in levels.

Table 3: Number of participants who changed their level from T1 to T3 (N=207)

Level at T1	**Levels at T3**							
	1	2	3	4	5	6	7	8
0 n=97	37	19	4	1	0	1	0	0
1 n=45	__	8	6	0	0	0	0	0
2 n=41	__	__	6	0	0	0	0	0
3 n=18	__	__	__	0	0	0	0	0
4 N=3	__	__	__	__	1	0	0	0
5 n=1	__	__	__	__	__	0	0	0
6 n=1	__	__	__	__	__	__	0	1
7 n=0	__	__	__	__	__	__	__	0
8 n=1	__	__	__	__	__	__	__	__

DISCUSSION

Currently, an instrument to identify changes in the use of new knowledge by technology stakeholders does not exist. Such an instrument should use concepts and language that can be shared by stakeholders of particular technology outcomes addressed by the work of NIDRR grantees. The KT4TT developed the LOKUS questionnaire after two content validity examinations by experts in the field of technology transfer. The resulting survey defined 10 developmental levels of use of new knowledge and 6 categories of activities possible under each level. It described 3 studies and took only 5-10 minutes to administer. In this study it had good face validity, very high test-retest reliability, and good responsiveness to detect changes. In comparison with a traditional survey administration method using pencil–and-paper, a web-based method may result in more conservative findings. This may be due to lack of or infrequent personal contact compared to the traditional person-to-person survey. However, the difference was minimal. Regarding categories under each level, we hypothesized that people engage in more activities before they move on to a next level. This study, however, was not able to test it, as it requires longitudinal data. This study addressed the AAC field and in order to generalize the usefulness of this tool, it should also be tested in other fields.

The LOKUS appears to be a reliable and valid questionnaire to identify a stakeholder's level of use of new knowledge generated by a NIDRR grantee. However, its generalization requires further testing in other contexts.

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