

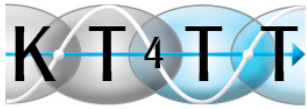
Knowledge Translation in Augmentative and Alternative Communication: A Randomized Controlled Study

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Background

Context: Knowledge Translation for Technology Transfer (KT4TT)

- **KT** (CIHR, 2004; 2005; 2009; Sudsawad, 2007)

- Addresses:

- ❑ Under-utilized Research (Weiss, 1979) ;
- ❑ Accountability of funded Research (GPRA; Wholey et al, 2004)

- Proposed solution: Research-to-practice

- **TT** (Lane, 2003)

Technology based R&D → K Outputs → Market Outcomes (products & services) → Societal Impact (User Benefits)

KT4TT: Links two processes to increase results.



KT4TT: an Example

K Output:

Age Appropriate Vocabulary and Symbol Sets for adult users of Augmentative and Alternative Communication technology (Bryen, 2008) ;

Outcomes:

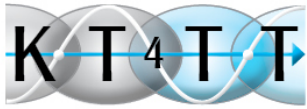
New vocabulary

- transformed by manufacturers for AAC machines ;
- fitted by clinicians for consumers;
- use facilitated by brokers,
- regulated by policy makers,
- advanced by researchers.

Impact:

Improved function & quality of life for consumers with complex communication needs.

KT4TT involves Creation & Strategic Communication of K to the above Stakeholders, to get Products and Services in market that benefit end users.



Purpose of the KT intervention studies

Problem: Sub-optimal level of demonstrated impact from R&D investment.

Challenge: Identify KT best practice models that are :

- Effective: increase K use by relevant stakeholders;
- Feasible : easy to implement; and
- Useful: K producers (technology grantees) can document evidence of impact from their project outputs

Purpose:

Develop and evaluate KT intervention strategies that are feasible for use by technology R&D projects and effective in increasing use of new knowledge by potential users.



Relevance of the Study

Funding agency: National Institute for Disability and Rehabilitation Research (NIDRR)

Beneficiaries: Persons with Disabilities

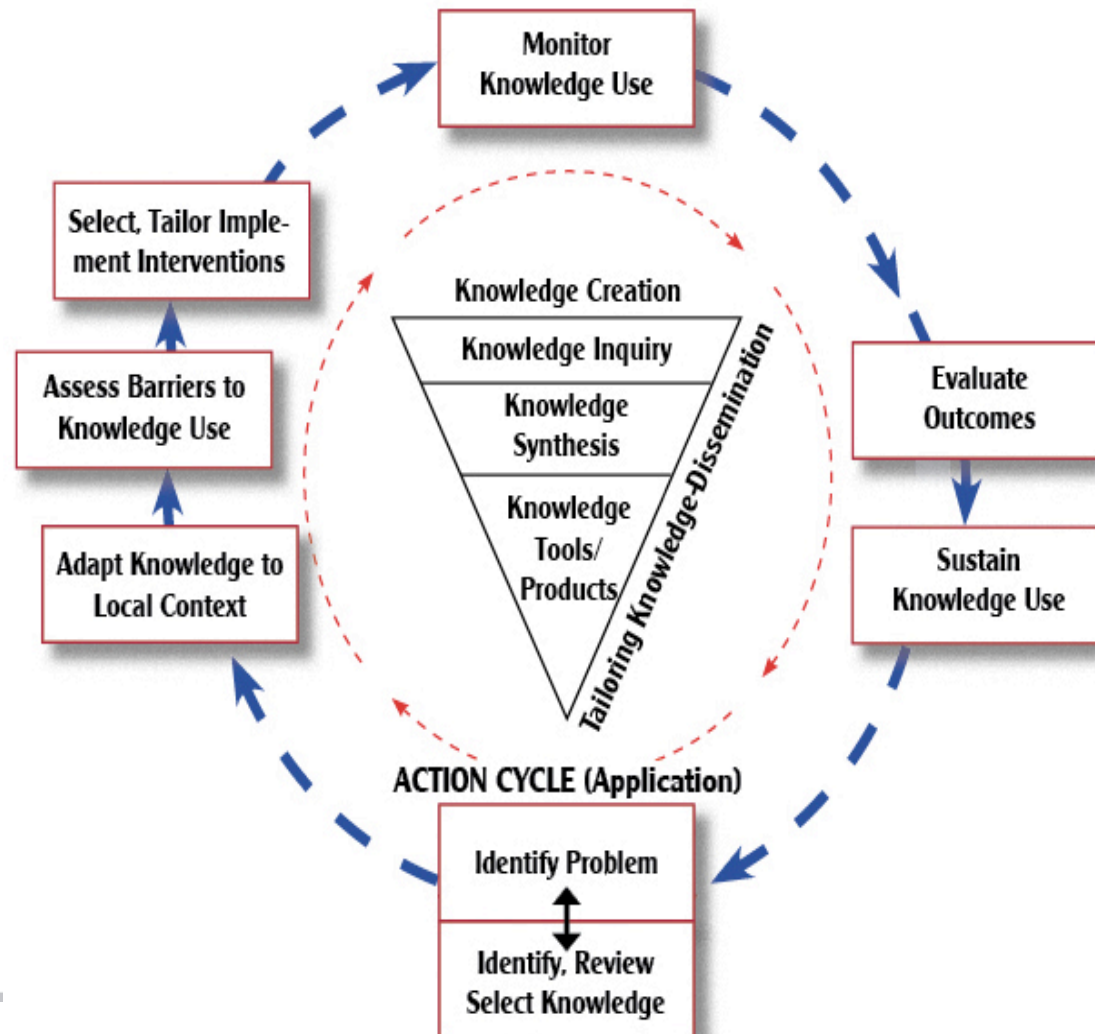
Knowledge Producers: NIDRR's Technology grantees (R&D projects) – RERC on AAC

Knowledge Users: (6 stakeholder groups)

- Manufacturers; Clinicians; Transition Brokers; Researchers; Policy makers; Consumers with disabilities

Guiding Concepts:

The Knowledge-to-Action (KTA) model (Graham, et al, 2006)





Guiding Concepts (Contd.)

- End-of-grant KT and Integrated KT
 - Intervention Study focus – end-of-grant outputs from NIDRR’s technology grantees.
- Knowledge Value Mapping (Rogers, 2000; Lane and Rogers, 2011)
Map needs, expectations and values of K users regarding research, its production and dissemination.
- Intervention
 - Tailoring of K (Contextualization)
 - Formats of communication (accessible, usable)
 - Multi modal channels of delivery (Sudsawad, 2007).

Intervention Study: Overall Design

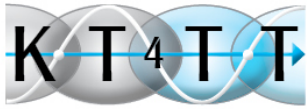
1. Select End-of-Grant Innovation (completed grantee research study)

Inclusion Criteria

- Quality- peer reviewed publication
- Innovation - Novel? Feasible? Useful?
- Selected K in AAC : Research by Bryen (2008) - Vocabulary for Adult users of AAC.

2. Create Intervention Strategy & tools

- Identify and Interview organizations
 - Prepare Knowledge Value Maps (KVM) –for User context, needs, expectations
 - Source of participants
- Tailored Tools:
 - Six “Contextualized Knowledge Packages” (CKPs)
 - Six Webinars (training)
 - Technical Assistance upon request



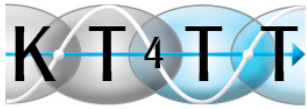
Intervention Study: Overall Design

3. Implement Intervention

- Targeted Dissemination: Recruit K users via organizations.

4. Evaluate Intervention

- Objective: Evaluate effectiveness of KT strategy for a given new K in AAC field; demonstrate what works for NIDRR and grantees (K producers).
- Compare Tailored Targeted Dissemination of K (TTDK) with Targeted Dissemination of K (TDK) and Control (traditional diffusion)
- Measure effects: Awareness, Interest and Use of New Knowledge.

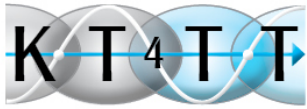


Research Questions

- R1: Are there differences in effectiveness among the 3 methods of communication, i.e., TTDK, TDK and Passive Diffusion, in terms of raising overall levels of K use by stakeholders?
- R2: Are there differences in change in overall levels of K use among the five types of stakeholders, i.e., brokers, clinicians, manufacturers, researchers and consumers?
- R3: Do individuals who reach more advanced level of K use have demographic characteristics and knowledge processing traits different from the individuals who do not reach advanced levels?

		Baseline Assessment	Intervention Delivery (4 Mo.)	Follow/up Test 1	Intervention Delivery (4 Mo.)	Follow/up Test 2
Five stakeholder types	R T ₁	O	X _{1a}	O	X _{1b}	O
	R T ₂	O	X ₂	O		O
	R C	O		O		O

Where T1=group exposed to TTDK; T2=group exposed to TDK; C=Control group; O=Observation (via LOKUS); X1a and X1b are components of TTDK method; & X2= TDK method.



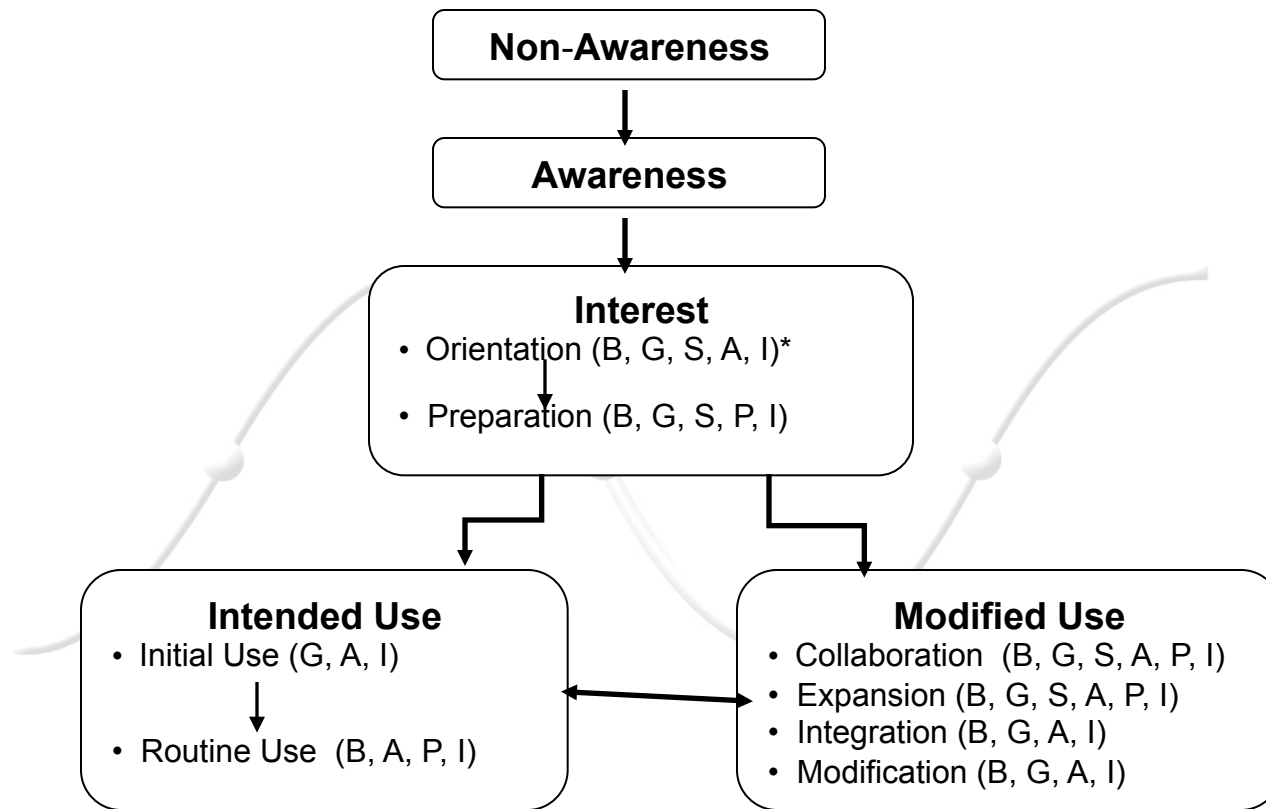
Instrument

Measure: Awareness, Interest and Use of New Knowledge

Tool: Level of Knowledge Use survey (LOKUS)

- Inspired by Hall et al, 2006;
- Initial version: 10 levels, 6 categories.
- Current version: 5 levels, 8 Dimensions; 6 Activities
- Web based survey – New K from 3 Studies; where A is Bryen's research; B & C are Distracters.
- Adequate content validity, exceptional test-retest reliability (1.0), strong convergence with a conventional pencil and paper survey, and solid construct validity to detect changes (Tomita, Stone & Telang, in preparation)

Conceptual Model of LOKUS

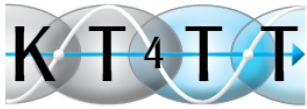


***Activities:**

B: Being Aware, G: Getting Information, S: Sharing, A: Assessing, P: Planning, I: Implementing

Sample Size

- Determined by power analysis
- Based on study by Miller and Spilker (2003)
- Needed $N=206$: for power = .80, $\alpha_1 = .05$, and effect size = .24.
- Planned $N=270$ considering attrition;
 - [3 study gps. x 6 stakeholder types x 15]
- Actual N after attrition = 207
 - ($T_1 = 72$; $T_2 = 72$; & Control = 63); Including 5 stakeholder types.



Recruitment

- Individuals presumed to have interest in AAC related research findings.
- Through national organizations of affiliation of Knowledge Users:
ATIA - American Technology and Industry Association; ASHA -American Speech and Hearing Association; ISAAC - International Society for Augmentative and Alternative Communication; NCIL – national council on Independent Living; AHEAD – Association on Higher Education and Disability.
- List of authors published in AAC research journals – (public domain)



Inclusion/Exclusion Criteria

Included:

- Is a broker, clinician, consumer, manufacturer or researcher in AAC; belongs to pertinent organization in the AAC field.
- Consumers of AAC above 18 years of age;
- Clinicians have clients above 18 years of age;
- Brokers offer disability services for students;
- Researchers do AAC related research.

Excluded:

Online Groups (AcuLog) or social networking sites with potential for cross-contamination among participant groups.

Results

Table 1. STUDY SAMPLE

		STUDY GROUP			
		T ₁ (TTDK)	T ₂ (TDK)	Control	Total
STAKEHOLDER TYPE	BROKER	23	23	19	65
	CLINICIAN	13	15	17	45
	MANUFACTURER	11	8	7	26
	RESEARCHER	8	7	6	21
	CONSUMER	17	19	14	50
	TOTAL	72	72	63	207

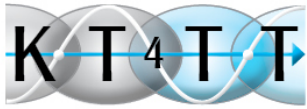


RESULTS: Demographic characteristics of participants

- No difference among participants allocated to the TTDK, TDK and Control groups regarding age, years of experience, gender, race/ethnicity, education and work status.
- 3 groups were equivalent.
- Tables 2a, 2b, 2c follow.

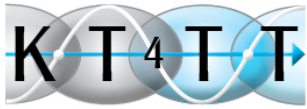
**Table 2a. Sample Characteristics
(All : N=207)**

GROUP →	T₁ (TTDK)	T₂ (TDK)	Control	Total	
	Mean (SD) (n=72)	Mean (SD) (n=72)	Mean (SD) (n=63)	Mean (SD) (n=207)	Difference F (p=)
Age (n=206)	45.21 (11.47) (n=72)	44.93 (12.21) (n=71)	41.68 (11.47) (n=63)	44.03 (11.78)	1.834 (. 162)
Years of Experience	15.61 (10.99)	13.34 (9.93)	13.40 (10.16)	14.15 (10.38)	1.099 (. 335)



**Table 2b. Sample Characteristics
(All : N=207)**

GROUP →	T₁ (TTDK)	T₂ (TDK)	Control	Total	
	Freq. (%) (n=72)	Freq. (%) (n=72)	Freq. (%) (n=63)	Freq. (%) (n=207)	Difference χ^2 (p=)
Gender					
Male	14 (19.4%)	19 (26.4%)	11 (17.5%)	44 (21.3%)	1.817 (.403)
Female	58 (80.6%)	53 (73.6%)	52 (82.5%)	163 (78.7%)	
Race					
White	67 (93.1%)	61 (84.7%)	57 (90.5%)	185 (89.4%)	16.776 (. 158)
Black	2 (2.8%)	3 (4.2%)	5 (7.9%)	10 (4.8%)	
Asian	0	2 (2.8%)	0	2 (1.0%)	
Hispanic	3 (4.2%)	1 (1.4%)	1 (1.6%)	5 (2.4%)	
Native American	0	3 (4.2%)	0	3 (1.4%)	
Other	0	2 (2.8%)	0	2 (1.0%)	



**Table 2c. Sample Characteristics
(All : N=207)**

GROUP →	T₁ (TTDK)	T₂ (TDK)	Control	Total	
	Freq. (%) (n=72)	Freq. (%) (n=72)	Freq. (%) (n=63)	Freq. (%) (n=207)	Difference χ^2 (p=)
Education					
<12 year	2 (2.8%)	1 (1.4%)	1 (1.6%)	4 (1.9%)	4.462 (.924)
HS	8 (11.1%)	7 (9.7%)	5 (7.9%)	20 (9.7%)	
2-year college	1 (1.4%)	3 (4.2%)	2 (3.2%)	6 (2.9%)	
BS/BA	11 (15.3%)	8 (11.1%)	11 (17.5%)	30 (14.5%)	
MA/BA	38 (52.8%)	39 (54.2%)	37 (58.7%)	114 (55.1%)	
Doctorate	12 (16.7%)	14 (19.4%)	7 (11.1%)	33 (15.9%)	
Work Status					
Full time	52 (72.2%)	48 (66.7%)	46 (73.0%)	146 (70.5%)	4.107 (.662)
Part time	13 (18.1%)	11 (15.3%)	6 (9.5%)	30 (14.5%)	
Unemployed	2 (2.8%)	3 (4.2%)	3 (4.8%)	8 (3.9%)	
Not employed	5 (6.9%)	10 (13.9%)	8 (12.7%)	23 (11.1%)	

Results (Contd.)

Table 3. KU Level Means for Study A at Base, F/up 1, and F/up 2 (N=207)

	New Knowledge from:	Baseline Mean (S.D.)	Follow/up 1 Mean (S.D.)	Follow/up 2 Mean (S.D.)	Difference χ^2 (p)	Post-hoc test Z (p)	
T1 (TTDK)	Study A (N=72)	1.22 (.68)	1.79 (1.16)	1.69 (1.03)	22.632 (<.001)	Base vs F/up1 3.826 (<.001)	Base vs F/up2 4.297 (<.001)
T2 (TDK)	Study A (N=72)	1.26 (.77)	1.76 (1.19)	1.74 (1.16)	13.884 (.001)	Base vs F/up1 3.330 (.001)	Base vs F/up2 3.206 (.001)
Control	Study A (N=63)	1.38 (.97)	1.51 (1.05)	1.73 (1.22)	6.484 (.039)		
<p>Both TTDK and TDK moved up significantly in K Use levels from baseline. They differed from the Control group, but not between each other.</p>							

Results (Contd.)

Table 4. Mean Change in KU Level: Differences among Three Groups for **Study A** (All; N=207)

KU Level Change →	T1(TTDK) Mean (S.D.)	T2(TDK) Mean (S.D.)	Control Mean (S.D.)	Difference χ^2 (p)
Baseline to F/up 1	.57 (1.12)	.50 (1.17)	.13 (1.01)	7.044 (.030)
Baseline to F/up 2	.47 (.82)	.47 (1.19)	.35 (1.19)	2.371 (.306)
F/up 1 to F/up 2	-.10 (1.20)	-.03 (.75)	.22 (1.13)	3.443 (.179)

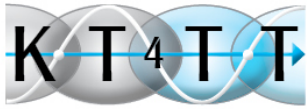
K Use level changes were significantly different among the 3 groups from baseline to Follow/up 1.



**Table 5a. Freq. comparisons between Baseline and F/Up1 reg. Non-Awareness/
Awareness+
(McNemar Test ;N=207)**

T1Group- TTDK (N=72)

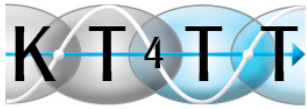
		Follow/UP 1			Exact Sig. (2-sided p=)
		Non- Awareness	Awareness+	Total	
Baseline	Non-Awareness	44	19	63	.001
	Awareness+	2	7	9	
	Total	46	26	72 (100%)	



**Table 5b. Freq. comparisons between Baseline and F/Up1 reg. Non-Awareness/
Awareness+
(McNemar Test ;N=207)**

T2Group- TDK (N=72)

		Follow/UP 1			Exact Sig. (2-sided p=)
		Non-Awareness	Awareness+	Total	
Baseline	Non-Awareness	46	17	63	.001
	Awareness+	2	7	9	
	Total	48	24	72 (100%)	



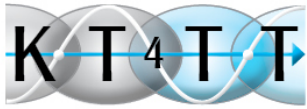
**Table 5c. Freq. comparisons between Baseline and F/Up1 reg. Non-Awareness/
Awareness+
(McNemar Test ;N=207)**

Control Group – N=63

		Follow/UP 1			Exact Sig. (2-sided p=)
		Non- Awareness	Awareness+	Total	
Baseline	Non- Awareness	48	6	54	.289
	Awareness+	2	7	9	
	Total	50	13	63 (100%)	

Table 6. Frequency Comparisons between Baseline & F/Up1 reg. Non-Use/Use (McNemar Test: N=207)

T1 TTDK (Study-A: N=72)		Follow/UP 1			Exact Sig. (2-sided p=)
		Non-Use	Use	Total	
Baseline	Non-Use	59	10	69	.039
	Use	2	1	3	
	Total	61	11	72	
T2 TDK (Study-A:N=72)		Follow/UP 1			Exact Sig. (2-sided p=)
		Non-Use	Use	Total	
Baseline	Non-Use	57	11	68	.022
	Use	2	2	4	
	Total	59	13	72	
Control (Study-A:N=63)		Follow/UP 1			Exact Sig. (2-sided p=)
		Non-Use	Use	Total	
Baseline	Non-Use	52	4	56	1.000
	Use	4	3	7	
	Total	56	7	63	



Summary of Results: Research Question 1

1. TTDK and TDK were effective in terms of change in level of K use. (Table 3)
2. Both TTDK and TDK were effective in raising K use level from Non-Awareness to Awareness and beyond (Tables 5a, 5b, 5c); as well as from Non-Use to Use (Table 6). Cell frequencies and exact levels of significance suggest TTDK and TDK were more effective in terms of raising awareness than in terms of moving non-users to use.
3. Analysis of these level *changes* (Table 4) showed TTDK and TDK more effective than passive diffusion method (control) from Baseline to Follow/up 1, but neither between Follow/up 1 and Follow/up 2, nor between baseline to Follow/up 2.

RESULTS: Differential effects among stakeholders

Table 7a. Level Change Differences among Stakeholder Types in the T1 (TTDK) Group

		N	Mean change in Level	SD	Kruskal Wallis P	Total Mean (SD)
Baseline to F/Up 1	Broker	23	.26	.915	4.883 (.300)	.57 (1.12)
	Clinicians	13	.46	.967		
	Manufacturers	11	.64	1.567		
	Researchers	8	1.00	1.195		
	Consumers	17	.82	1.131		
	Total	72	.57	1.124		
Baseline to F/Up 2	Broker	23	.04	.367	13.087 (.011) Broker vs. Manuf.	.47 (.82)
	Clinicians	13	.62	.768		
	Manufacturers	11	1.00	1.000		
	Researchers	8	.63	1.061		
	Consumers	17	.53	.874		
	Total	72	.47	.822		
F/Up 1 to F/Up 2	Broker	23	-.22	.902	5.333 (.255)	-.10 (1.2)
	Clinicians	13	.15	1.144		
	Manufacturers	11	.36	1.120		
	Researchers	8	-.38	1.685		
	Consumers	17	-.29	1.404		
	Total	72	-.10	1.200		

Table 7b. Level Change Differences among Stakeholder Types: T2 (TDK)

		N	Mean change in Level	SD	Kruskal Wallis P	Total Mean (SD)
Baseline to F/Up 1	Broker	23	.26	.752	2.630 (.623)	.50 (1.18)
	Clinicians	15	.33	1.234		
	Manufactures	8	.50	1.604		
	Researchers	7	.43	.787		
	Consumers	19	.95	1.433		
	Total	72	.50	1.175		
Baseline to F/Up 2	Broker	23	.13	.626	4.045 (.400)	.47 (1.19)
	Clinicians	15	.40	1.183		
	Manufactures	8	.38	1.598		
	Researchers	7	.43	.976		
	Consumers	19	1.00	1.491		
	Total	72	.47	1.186		
F/Up 1 to F/Up 2	Broker	23	-.13	.458	3.343 (.502)	-.03 (.75)
	Clinicians	15	.07	1.033		
	Manufactures	8	-.13	.354		
	Researchers	7	.00	1.000		
	Consumers	19	.05	.848		
	Total	72	-.03	.750		

Table 7c. Level Change Differences among Stakeholder Types : CONTROL Group

		N	Mean change in Level	SD	Kruskal Wallis P	Total Mean (SD)
Baseline to F/Up 1	Broker	19	.16	.688	7.527 (.111)	.13 (1.10)
	Clinicians	17	.29	.849		
	Manufactures	7	-.57	1.134		
	Researchers	6	-.17	.408		
	Consumers	14	.36	1.499		
	Total	63	.13	1.008		
Baseline to F/Up 2	Broker	19	.16	.501	6.614 (.158)	.35 (1.19)
	Clinicians	17	.24	.752		
	Manufactures	7	-.14	1.773		
	Researchers	6	1.33	1.506		
	Consumers	14	.57	1.651		
	Total	63	.35	1.194		
F/Up 1 to F/Up 2	Broker	19	.00	.882	9.262 (.055)	.22 (1.13)
	Clinicians	17	-.06	1.197		
	Manufactures	7	.43	1.272		
	Researchers	6	1.50	1.378		
	Consumers	14	.21	.893		
	Total	63	.22	1.128		



Summary of Results - Research Question 2

From baseline to Follow/up 1 and from Follow/up 1 to Follow/up 2, there were no differences among stakeholders (Tables 7a, 7b and 7c).

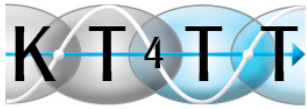
However, a significant difference was identified between brokers and manufacturers between Baseline and Follow/up 2 for the TTDK group only. Manufacturers moved up the most and brokers the least (Table 7a).

Results (Contd.)

**Table 8a. Change in Level from Baseline to F/Up 1 and participant characteristics
TTDK on Study A: (N=72)**

	Levels	N	Mean	Standard Deviation	Difference U (p)
Age	≤ 44	35	.71	1.152	580.0 (.381)
	≥ 45	37	.43	1.094	
Years of Experience	≤ 14	38	.66	1.122	607.0 (.612)
	≥ 15	34	.47	1.134	
Gender	Male	14	.79	1.251	359.0 (.441)
	Female	58	.52	1.096	
Race	Majority	67	.51	1.078	105.0 (.175)
	Minority	5	1.40	1.517	
Education	≤ 2 Years College	11	.91	1.221	270.0 (.237)
	≥ BS/BA	61	.51	1.105	
Work Status	Full Time	52	.46	1.093	430.0 (.192)
	Not Full Time	20	.85	1.182	
Baseline Level	Non-Awareness	63	.30	.463	154.0 (.005)
	Awareness +	9	-.22	.441	

Change in K Use was more for the “non-aware” participants.

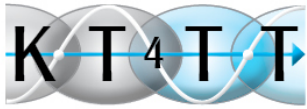


Results (Contd.)

Table 8b. Baseline to F/Up 1 Change in Level and participant characteristics: TDK on Study A: (N=72)

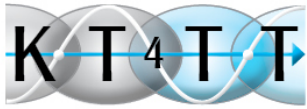
	Levels	N	Mean	S.D.	Difference U (p)
Age (n=71)	≤ 44	39	.56	1.119	580.0 (.534)
	≥ 45	32	.34	1.181	
Years of Experience	≤ 14	44	.20	.878	430.5 (.009)
	≥ 15	28	.96	1.427	
Gender	Male	19	.63	1.165	470.5 (.610)
	Female	53	.45	1.186	
Race	Majority	61	.52	1.219	319.0 (.755)
	Minority	11	.36	.924	
Education	≤ 2 Years College	11	1.36	1.433	203.0 (.012)
	≥ BS/BA	61	.34	1.063	
Work Status	Full Time	48	.44	1.201	519.5 (.414)
	Not Full Time	24	.63	1.135	
Baseline Level	Non-Awareness	63	.27	.447	161.0 (.007)
	Awareness +	9	-.22	.441	

In the TDK group, change in K Use was more for the more experienced, the less educated and the “non-aware”.



Summary of Results - Research Question 3

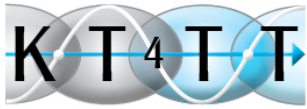
- Participants in the TTDK group who were at the Non-Awareness level regarding Bryen's findings at baseline moved up significantly more than participants who were at Awareness and above (Table 8a).
- In the TDK group, participants who were at the Non-Awareness level for Bryen's findings at baseline moved up significantly to Follow/up 1 more than others. Additionally, those who had lower education levels (<2year-college), and those with more years of experience (15 yrs or more) moved up significantly more than the others in these characteristics (Table 8b).



Conclusions

Conclusions are tentative; replication RCTs are underway.

1. Targeting stakeholders for dissemination (common component of TTDK and TDK) is an effective way to raise K use; although Tailoring did not add to KT effectiveness.
2. Within TTDK, the tailored CKP was effective (intervention between baseline and Follow/up 1); however, the tailored webcast was not(intervention between Follow/ups 1 and 2).
3. Both TTDK and TDK were more effective in moving stakeholders beyond non-awareness than in moving non-users to use. (Approx. 30% Vs. 15%)
4. No differential effects on stakeholders except brokers vs. manufacturers for TTDK. Suggests that tailoring the K (in AAC) might hold most value for manufacturers in this field, and least for brokers (K use facilitators in academic environment)
5. Both TTDK and TDK strategies were more effective with those who are at the Non-awareness level. Corroborates earlier conclusion #3.
6. The TDK (disseminating the original article about K with no CKP) was more effective in raising awareness of those with lower educational level and those who were more experienced working with AAC.



Discussion

Conclusions are tentative, and replication is desirable.

Replication studies should consider effects of CKP vs. webcast/Tech assistance. Did the order of intervention play a role? Did the duration of intervention play a role?

Nevertheless, the main results are not surprising.

End-of-Grant KT (evaluated in this study) assumes audience have needs for the K generated; proposes finding the problem for which the K could be a solution.

The opposite is argued in the Prior-to-grant KT approach proposed in the NtK model (Lane & Flagg, 2010).

Based on Project's TT experience;

Need should be validated prior to initiating any technology based R&D project.

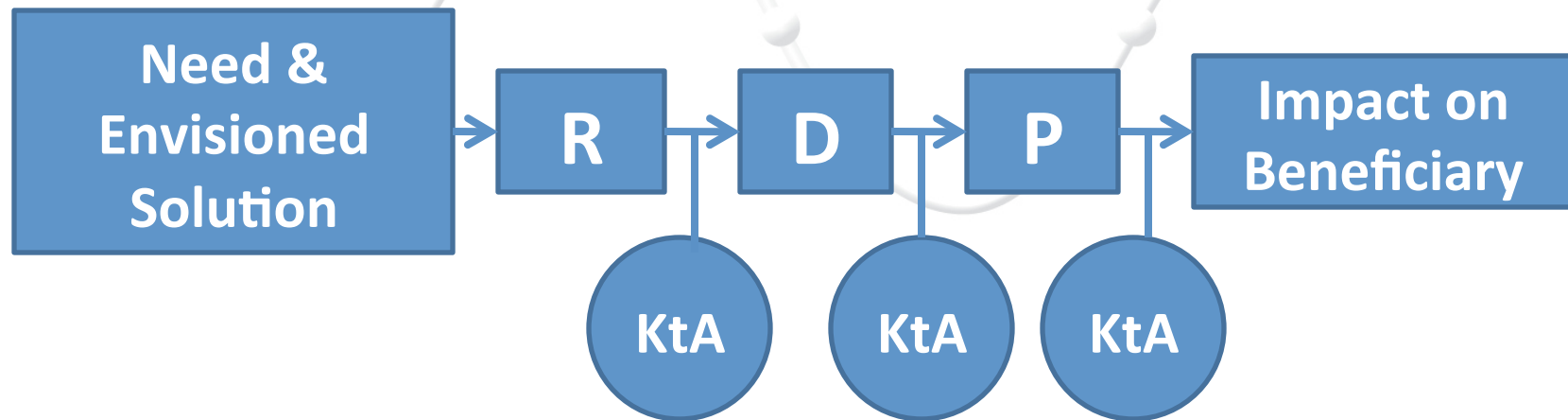
Future RCTs to test this may shed further light.

A KT Framework for Technology Based Innovations

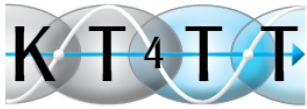
Need to Knowledge (NtK) Model

(Lane and Flagg, 2010)

<http://kt4tt.buffalo.edu/knowledgebase/model.php>



- 3 processes; 3 states of K; 3 outputs
- Introduces Prior-to-grant KT



Discussion: Evaluation Quality

Intervention Evaluation considered professional Standards

- Utility: Effective KT strategy for use by grantee; specific feedback from K users for strategy refinement.
- Feasibility – KT strategy conceptualized from grantee perspective, & replicated for different technology outputs.
- Accuracy – RCT design (merit) + follow up (worth).
- Propriety – involve K producer (grantee) in translation.

Evaluation considered both rigor and relevance as important for KT:

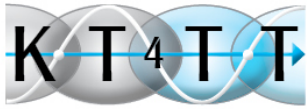
- Is the K credible? --- Merit (rigor) of evidence (Peer reviewed publication)
- Is the K worthy? --- Relevance to K users (Review Committee of Stakeholders)



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