Developing a valid and reliable assessment on knowledge translation in the continuing professional development (CPD) of health professionals

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Introduction

Knowledge Translation (KT) is expected to be a critical learning outcome of a Continuing Professional Development (CPD) program. It continues to serve as an area of interest among educators and healthcare providers due to its importance to evidence-based practice. This study endeavored to develop a KT learning assessment tool in CPD.

Methods

The Inventory of Reflective Vignettes (IRV), an innovative approach of integrating research vignettes was utilized in crafting the 20-item IRV-KT tool. This instrument identified knowledge creation and action as essential KT constructs. Using a one-group post-posttest pre-experimental design, the KT competency was assessed in 3 moments (i.e. before and after CPD event and if in a lecture). Health professionals who successfully completed a CPD program using alternative teaching approaches were asked to complete the IRV-KT during the pilot study ($n = 10$) and actual implementation ($n = 45$). Responses were subjected to Cronbach's reliability and criterion-validity testing.

Results

The initial test of the IRV-KT tool revealed a high internal reliability ($\alpha = 0.97$) and most items yielded acceptable validity scores. During the actual implementation, a higher reliability score of 0.98 was generated with significant correlations between the before-after segments for both KT constructs of creation ($r = 0.33$, $p < 0.05$) and action ($r = 0.49$, $p < 0.05$). All items have significant positive large validity coefficients ($r > 0.35$, $p < 0.05$) in all segments.

Discussion

The study practically produced reflective assessment tool to assess validly and reliability KT learning in a CPD. IRV-KT is seen to guide curriculum process of CPD programs to bridge learning and healthcare outcomes.

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15 **Abstract**
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Introduction

Knowledge Translation (KT) has been prominent in the health fields (Lang, Wyer & Haynes, 2007; Lencucha, Kothari & Rouse, 2007; Armstrong et al., 2013). Its main focus has been largely on practice and research, than educational and professional development (Urquhart et al., 2013). In particular, knowledge itself happens to be essential to knowledge translation (Metzler & Metz, 2010), and likewise learning. Both United Nations Educational, Scientific and Cultural Organization (UNESCO-IBE, 2013) and European Centre for the Development of Vocational Training (2014) have agreed that knowledge covers a multitude of definitions, and much more important it is considered as a learning outcome. As a learning approach, KT has no agreed conceptual framework and platform (Pablos-Mendez & Shademani, 2006).

The 'know-do' gap chiefly reflects declarative and procedural knowledge. This corresponds to UNESCO's four pillars of education that is learning to (a) know, (b) do, (c) be, and (d) live together (Tawil & Cougoureux, 2013). KT seems to have a resemblance with (a) constructivist learning theory (Thomas et al., 2014) on the premise that learners constructs new knowledge, as well as (b) outcomes-based education on transforming the declarative knowledge into functioning knowledge in a professional education (Biggs & Tang, 2007, 2011). These principles put forward the importance of integrating knowledge translation in any teaching and learning activities. There are limited embedded assessments that would capture its natural occurrence in various learning contexts, more so in a Continuing Professional Development (CPD). Thus, this study worked toward a valid and reliable assessment tool in measuring KT competency as a CPD learning outcome.

Foundation of Knowledge Translation (KT)

The universal "know-do" gap (i.e. the gap between theory, knowledge, evidence or research, and practice, application, policy or decision) remains to be a critical challenge even in the contemporary world (Pablos-Mendez & Shademani, 2006; Santesso & Tugwell, 2006; Mustard, 2010; Grimshaw et al., 2012; Atchan, Davis & Foureur, 2014; Health Policy Project, 2014; Zhang et al., 2015). Although knowledge possesses an inherent catalytic potential in advancing the globalized society such as inclusive knowledge societies and knowledge-based economy (CEDEFOP, 2014; Pablos-Mendez & Shademani, 2006; Souter, 2014; UNESCO-IBE, 2013), it requires meaningful and contextual applications to elicit desired outcomes (Santesso & Tugwell, 2006; Bassi et al., 2013). Both CPD and KT offers mutually reinforcing strategies (Graham et al., 2006; Davis & Davis, 2010; Kitto et al., 2013) in putting knowledge to work. In essence, this stresses three-sided (i.e. researchers, educators and practitioners) collaboration (Bjørk et al., 2013) that is similar to the European Commission's (European Commission, 2015) knowledge triangle – education, research and innovations.

Several authors (Ho et al., 2004; Wallin, 2009; Metzler & Metz, 2010; Kothari & Armstrong, 2011; Straus, Tetroe & Graham, 2011; Sibley et al., 2011; Collisson et al., 2011; Kastner & Straus, 2012; Muntaner et al., 2012; Wolfe et al., 2012; Bassi et al., 2013; Gholami et al., 2013; Urquhart et al., 2013; Bjørk et al., 2013) have espoused the widely accepted Canadian Institutes of Health Research's (Canadian Institutes of Health Research, 2014) definition of KT as a continuous knowledge processing (i.e. synthesis, dissemination, exchange and application)

90 within a complex interactive system of researchers and knowledge users. Correspondingly,
91 knowledge-to-action (KTA) process (Graham et al., 2006) generally illustrates KT that offers an
92 alternative framework to bridge the know-do gap in the 21st century. It emphasizes the cyclic
93 coexistence of knowledge creation and application. During the creation phase, knowledge
94 requires to undergo a refinement process such as inquiry, synthesis and development. Whereas,
95 the action part involves activities needed for actual knowledge application such as adaptation,
96 intervention, evaluation and continuation.
97
98   Graham et al. (Graham et al., 2006) clarified common shared concepts of KT. *Knowledge*
99 *transfer* exclusively describes a linear top-down approach (Visram, Goodall & Steven, 2014),
100 and one-way (or impliedly can be two-way) process of getting knowledge with no actual
101 application. This reflects a mere sending of information to a user (Majdzadeh et al., 2008),
102 though Froese & Montgomery (Froese & Montgomery, 2014) have viewed knowledge transfer
103 synonymously with knowledge translation. These views concur with Choi & Johanson's (Choi &
104 Johanson, 2012) comparison of the (a) *static*, (b) *dynamic* and (c) *knowledge translation*
105 *perspectives* of knowledge transfer, respectively. In the same way, *knowledge exchange* as a two-
106 way process (Visram, Goodall & Steven, 2014) has been conceived to release some restrictions
107 of transfer. Knowledge exchange expands the transfer concept by giving emphasis to the
108 collaborative roles between the researchers, leaders and stakeholders. This ensures relevant
109 knowledge is available, though involvement may vary throughout the process. Several studies
110 have compounded these terms as *knowledge translation and exchange (KTE)* to further
111 strengthen the involved interactive mechanisms (Légaré et al., 2011; Wolfe et al., 2012; Visram,
112 Goodall & Steven, 2014). On the contrary*, research utilization* (or implementation) directs its
113 effort on the use of research evidences only. This shares almost a similar stand with *evidence-*
114 *based practice (EBP)* that uses best evidences as the ideal knowledge in guiding decision and
115 practice (Wallin, 2009; Metzler & Metz, 2010; Atchan, Davis & Foureur, 2014). Lastly,
116 *translational research* may seem similar, yet it deals with the transfer of basic scientific
117 knowledge to clinical application. In contrast, Grimshaw et al. (Grimshaw et al., 2012) embraced
118 the view of translation research as their frames for knowledge translation. This refers to the
119 second type of translational research, which deals with improving health outcomes using new
120 clinical knowledge. In spite of their differences, these concepts are subsumed under the broader
121 context of KT.
122
123 *Strategies of Knowledge Translation (KT)*
124
125   Despite availability of many theoretical supports and models (Sibley et al., 2011; Brehaut
126 & Eva, 2012; Larrivée, Hamelin-Brabant & Lessard, 2012; Thomas et al., 2014), there has been
127 no single strategy for KT (Metzler & Metz, 2010; Gholami et al., 2011; Grimshaw et al., 2012;
128 Kastner & Straus, 2012; Visram, Goodall & Steven, 2014). At large, the Canadian Institute of
129 Health Research (Canadian Institutes of Health Research, 2014) has specified two (2) general KT
130 approaches. The traditional (Kothari & Wathen, 2013) *end-of-grant knowledge translation*
131 empowers the researcher to make the stakeholders (e.g. users and clients) and their peers aware
132 of the research evidences as knowledge. This may involve typical research dissemination (e.g.
133 conferences, presentations and publications) and intensive activities such as interactive sessions,
134 educational events and knowledge brokering. As for the *integrated knowledge translation (IKT)*,
135 the knowledge researcher and user engages in a meaningful collaboration towards sustainable

outcomes. Its strategies may include action research, knowledge co-creation and participatory methods (Tetroe, 2007). Likewise, Collisson & colleagues (Collisson et al., 2011) have pointed out that these KT approaches share a direct link with their knowledge production mode. The independent knowledge production leads to the academic merits of end-of-grant KT, while collaborative generation facilitates integrated KT for a direct contextual application.

Another KT strategy integrates modern technology with it to yield a *Technology-Enabled Knowledge Translation (TEKT)* (Bassi et al., 2013; Urquhart et al., 2013). This embodies the convergence of technology and innovation with KT, which supports information collection, production and distribution (Pablos-Mendez & Shademani, 2006; Majdzadeh et al., 2008; Urquhart et al., 2013). Several scholars (Ho et al., 2004; Bassi et al., 2013) have maintained positive views on TEKT's potentials for online education, web-based intervention and integrated systems. In a similar manner, *informatics-based knowledge translation* optimizes the utilization of information system for an adjunctive mechanism such as clinical decision support systems and healthcare information systems (Kastner & Straus, 2012). Relatedly, social media open new opportunities in reinforcing knowledge translation activities and interactions (Hamm et al., 2013). In other situations, the social environment becomes the strategic center of knowledge translation such as community of practice (Lencucha, Kothari & Rouse, 2007; Urquhart et al., 2013), virtual community (Bassi et al., 2013) and community-based settings (Kothari & Armstrong, 2011).

Interestingly, most KT strategies tend to hold educational activities (Zwarenstein & Reeves, 2006; Majdzadeh et al., 2008; Wallin, 2009; Reitmanova, 2009; Davis & Davis, 2010; Straus et al., 2011; Wahabi & Al-Ansary, 2011; Grimshaw et al., 2012; Larrivée, Hamelin-Brabant & Lessard, 2012; Armstrong et al., 2013; Bassi et al., 2013; Thomas et al., 2014). Regardless of whether a standalone or combined intervention, KT activities may include learning activities (e.g. seminar, lectures, workshops, outreach, trainings and meetings) (Graham et al., 2006; Wahabi & Al-Ansary, 2011; Grimshaw et al., 2012; Armstrong et al., 2013; Bassi et al., 2013; Urquhart et al., 2013) and CPD (Grimshaw et al., 2006; Pablos-Mendez & Shademani, 2006; Santesso & Tugwell, 2006; Davis & Davis, 2010; Metzler & Metz, 2010). Under this circumstances, KT and CPD can be apparently overlapping and confusing (Graham et al., 2006). Kitto & associates (Kitto et al., 2013) expounded the harmonies, distinctions and associations of these academic domains. Both KT and CPD aspire to improve collaborations, services and outcomes, though their underlying approach may differ. CPD gives attention to developing competence and performance of health professionals (Enriquez et al., 2015), whereas KT ensures quality information and tools for the stakeholders. Despite their differences, KT and CPD maintains a mutual relationship and shares common challenges. KT adapts theoretical foundations from CPD, while CPD exploits KT as a substantial rationale for its strategies.

Methods

In pursuit of developing a reflective tool on assessing KT learning in a CPD program, this study embarked on utilizing the tool development framework of Ong, Diño, Calimag, and Hidalgo (2018). In their work, they developed the Inventory of Reflective Vignettes (IRV) to guide them in designing a valid and reliable tool for interprofessional learning. The use of vignettes or scenarios (Datta Gupta, Kristensen & Pozzoli, 2010; Hudson & Cairns, 2014;

182 Gesinde, Temitope & David, 2014) are proven to be highly correlated with the actual outcomes
183 (Colón-Emeric et al., 2017). It can propel concrete thinking and elicit opinions (Santos-
184 Eggimann & Meylan, 2017). The IRV integrated a 6-point Likert scale for reflective
185 measurement of desired competencies (a) prior CPD, (b) upon CPD completion, and (c) during a
186 vignette situation. Similarly, a one-group post-posttest pre-experimental design was implemented
187 in this study to establish the validity and reliability measures of the designed KT assessment tool.
188 Following their tool development process, the content design involves literature reviews (Shrader
189 et al., 2017) in identifying key constructs of KT (*Figure 1*) and corresponding items. The
190 designed tool went through expert review ($n = 5$) for face validation.
191
192 After the research protocol was approved by an accredited ethics review committee of the
193 Philippine Health Research Ethics Board, the pilot study (n = 10) was conducted on November
194 2017 in a university-offered CPD program for health professionals using alternative teaching
195 methods. The initial Cronbach's analysis (*Table 1*) underscores the high internal reliability ($\alpha =$
196 0.97) of the designed tool. IRV-KT has excellent item consistency in estimating KT learning in
197 each segment that is before ($\alpha = 0.96$), after ($\alpha = 0.96$), and if ($\alpha = 0.99$). This is likewise
198 reflected on the identified KT constructs, which are creation ($\alpha = 0.96$) and action ($\alpha = 0.96$).
199
200 The preliminary analysis also tested the IRV-KT for validity. Its initial face and content
201 validation provided the tool with a criterion. To estimate its validity coefficient, each item were
202 correlated with the summative score of all segments. The statistical validity (*Table 2*) presented
203 varying coefficients. All "If" ($n = 20$) and many "Before" (n = 14) items yielded significant
204 correlations ($p < 0.05$), whereas most "After" items failed to demonstrate criterion validity.
205
206 IRV-KT went through further improvement using the findings from the pilot testing and
207 focus group discussion. A small sample pilot study was intended to supply preliminary evidence
208 of the tool applicability of use (Kennedy et al., 2018). The statement of each item were reworded
209 for clarity and specificity. In the actual implementation on December 2017, the study
210 participants ($n = 45$) were tasked to accomplish the IRV-KT at the end of the non-lecture CPD
211 program for health professionals. Their responses were analyzed to determine its test reliability
212 (Batterham & George, 2003) and criterion-related validity (Peeters & Martin, 2017).
213
214 **Results**
215
216 The study evaluated the designed IRV-KT tool (Tool S1) for validity and reliability of its
217 measures. After the actual implementation ($n = 45$), the IRV-KT maintained its excellent internal
218 reliability (*Table 3*) with Cronbach's coefficient of 0.98 which is higher than pilot result. Its high
219 internal consistency was cascaded down to all constructs ($\alpha = 0.97$) of every segments ($\alpha = 0.98$).
220 This indicates that IRV-KT can generate reliable measure of KT learning competencies.
221
222 The correlation study as to segments (*Table 4*) shows the presence of significant
223 relationship among segments. Surprisingly, only the before and after segments have statistical
224 significance in the creation ($r = 0.33$, $p < 0.05$) and action ($r = 0.49$, $p < 0.05$) constructs.
225 Although this is expected, the before and after segments have a limited relationship. This
226 suggests that IRV-KT can provide reliable and at the same time relative estimates of KT learning
227 competency in actual (i.e. before and after CPD) and hypothetical (i.e. vignette) situations.

228
229   The estimates of statistical validity (*Table 5*) shows the correlations of the items in every
230   construct. All items have significant positive large validity coefficients ($r > 0.35$, $p < 0.05$) in all
231   segments. This strongly implies that the IRV-KT is considered to be very beneficial tool in
232   assessing KT learning competencies at different segments. Moreover, it was able to measure
233   baseline performance indicating postdictive validity and vicarious experience showing predictive
234   validity. Thus, the IRV-KT can assess KT as a learning outcome of both actual and
235   circumstantial CPD.
236
237   **Discussion**
238
239   *IRV-KT as a valid and reliable tool*
240
241   The study findings confirm the validity of the IRV-KT tool. As expected, this instrument
242   would provide valid measures of KT learning, because it was developed using substantial
243   sources. Its strength as a learning tool primarily rests on its capacity to offer reproducible results
244   in both technical (i.e. style and format) and instructional (i.e. content and learning process)
245   aspects of KT as a desirable outcome of a CPD program. The IRV-KT is also reliable in
246   assessing KT constructs of 'creation' and 'action' that resulted in a commendable overall tool
247   reliability.
248
249   KT, an area of interest in continuing professional education is a constructive response to
250   fill in the gray space within the "know-do gap" (Bero et al., 1998; Thompson et al., 2007). For
251   instance, it has been reported that high quality evidence is not found in actual professional
252   practice (Majumdar, McAlister & Furberg, 2004; Larrivée, Hamelin-Brabant & Lessard, 2012;
253   Negrini et al., 2017). In the field of education, the IRV-KT tool could serve as a potent
254   instrument to ascertain KT competency outcomes among health professionals as lifelong learners
255   in eliciting evidence-based policies, decisions, and practices.
256
257
258   *IRV-KT as a reflective and meaningful assessment*
259
260   The IRV-KT tool is considered useful for it can cultivate deeper reflection on self-
261   performance and authentic functioning knowledge. Further, it provides concrete mechanism for
262   metacognitive thinking through awareness of one's learning (Montagna, Benaglio & Zannini,
263   2010). Self-reflection has been proven as a valuable exercise in both learning (Semradova &
264   Hubackova, 2015) and instruction (Williamson, 2018). In literatures, it is being used to evaluate
265   teaching methods, strategies and approaches (Klimova, 2014). Reflecting on one's learning
266   further improves critical thinking and insight that are directly translatable to actions and changes
267   of behavior (Lew & Schmidt, 2011; Asselin & Fain, 2013; Gardner, 2013).
268
269   It is important to assess KT among health professionals for it directly impacts practice
270   quality (Pablos-Mendez & Shademani, 2006). IRV-KT tool boasts its capacity to identify key
271   processes of knowledge translation through its constructs. It focuses on specific concrete tasks
272   (and not purely theoretical dimensions) involved in epistemic construction and application. Thus,

273 educators can be benefitted greatly from direct utilization of this tool in the field of health
274 sciences and healthcare, more so in the CPD learning context.
275
276 *IRV as a practical tool development framework*
277
278 Like in the previous study (Ong et al., 2018), using the IRV framework and its
279 procedures can produce valid and reliable reflective assessments. It provides a down to earth
280 framework that is easy to incorporate in real-world scenarios. The demand for instruments
281 focusing in Knowledge Translation is increasing (Ellen et al., 2017), but still remains to be a
282 gray area of literatures (Chen et al., 2017). Whilst most are focused initially on validity and
283 reliability concepts (Hinkin, Tracey & Enz, 1997), fewer studies have dwelt on the pragmatic
284 educational usage of research instruments. In these cases, the expeditiousness of using the IRV
285 framework is a valuable add-on in developing more assessment and research tools with practical
286 value.
287
288 **Conclusion**
289
290 The study designed the IRV-KT and established its validity and reliability on assessing
291 KT in CPD. It clearly identified creation and action as the key constructs of KT. The findings
292 also emphasized the educational value of IRV-KT in providing reflective assessment of KT
293 competencies and IRV framework in developing sound learning assessments. This study
294 afforded a substantial strategy on KT assessment using post-post test administration. Educational
295 leaders, planners, and implementers in the health sciences are encouraged to utilize the IRV-KT
296 beyond CPD contexts for the assessment of both teaching and learning. Cognizant of the study
297 limitations and constraints, further studies need to explore IRV-KT by construct validity testing
298 to determine its convergent and discriminant interrelationships. IRV-KT is consequently viewed
299 to be an indispensable instrument for guiding the development, implementation, evaluation, and
300 improvement of CPD programs for health professionals.
301
302 **Acknowledgments**
303
308
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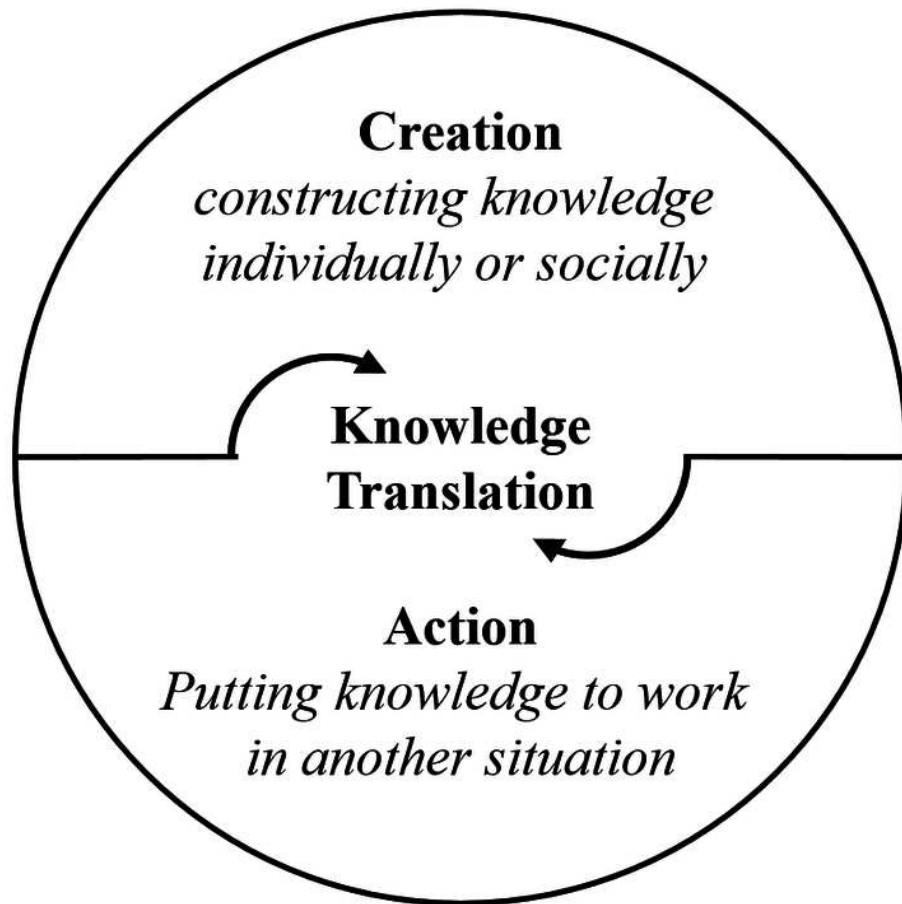
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539

Figure 1

Identified KT constructs as outcomes

Creation
*constructing knowledge
individually or socially*

**Knowledge
Translation**

Action
*Putting knowledge to work
in another situation*

*Valuable learning interactions of continuous knowledge
processing among health professionals in a CPD event*

Table 1(on next page)

Pilot Test Reliability ($n = 10$)

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Constructs (n of items)	Before	After	If	Overall
Creation ($n = 10$)	0.95	0.95	0.99	0.96
Action ($n = 10$)	0.94	0.93	0.99	0.95
Overall	0.96	0.96	0.99	0.97

1

2

Table 2(on next page)

Pilot Validity Testing

KT Constructs and Items	Segments (r)		
	Before	After	If
Creation			
Share my thoughts/ideas	0.53	0.52	0.70*
Retrieve relevant information	0.90*	0.19	0.96*
Explain the need for information	0.81*	0.61	0.87*
Analyze the usefulness of information	0.69*	0.48	0.86*
Evaluate the information	0.83*	0.69*	0.86*
Appreciate literature reviews	0.73*	0.28	0.91*
Determine the gaps/needs	0.59	0.69*	0.87*
Recommend useful solution	0.93*	0.83*	0.90*
Work well with others	0.52	0.03	0.78*
Develop new products	0.72*	0.32	0.85*
Action			
Apply a team approach	0.84*	0.22	0.81*
Use knowledge in many situations	0.59	0.34	0.89*
Fit my knowledge within a context	0.63*	0.32	0.84*
Apply my knowledge	0.51	0.58	0.81*
Build my confidence	0.34	-0.20	0.90*
Make sound decisions	0.69*	0.14	0.84*
Recognize the knowledge in action	0.69*	0.48	0.79*
Reflect on my knowledge use	0.76*	0.76*	0.79*
Enjoy getting feedback	0.65*	0.00	0.75*
Share the results with others	0.73*	0.01	0.81*

1   *Significant at 0.05 alpha level
2

Table 3(on next page)

IRV-KT Test Reliability ($n = 45$)

Constructs (n of items)	Before	After	If	Overall
Creation ($n = 10$)	0.98	0.97	0.96	0.97
Action ($n = 10$)	0.96	0.97	0.97	0.97
Overall	0.98	0.98	0.98	0.98

1

Table 4 (on next page)

Relation matrix of KT constructs as to segments

Constructs	Segments (r)		
	Before	After	If
Creation			
Before	-		
After	0.33*	-	
If	0.28	0.01	-
Action			
Before	-		
After	0.49*	-	
If	0.16	0.19	-

1   *Significant at 0.05 alpha level
2

Table 5(on next page)

Criterion-Related Validity Measures of IRV-KT

KT Constructs and Items	Segments (r)		
	Before	After	If
Creation			
Share my thoughts/ideas with others	0.64*	0.47*	0.52*
Retrieve relevant evidences/information	0.71*	0.52*	0.56*
Explain the need for searching scientific information	0.72*	0.61*	0.57*
Analyze the usefulness of a reliable information	0.76*	0.51*	0.55*
Evaluate the data and information critically	0.73*	0.58*	0.55*
Appreciate the value of reviewing literatures/sources	0.66*	0.55*	0.50*
Determine the gaps/needs of a given situation	0.68*	0.53*	0.63*
Recommend useful solution/information for application	0.68*	0.59*	0.58*
Work well with others in making plans/strategies	0.64*	0.55*	0.51*
Develop new knowledge/products based on the needs	0.71*	0.59*	0.65*
Action			
Apply a team approach in the use of knowledge	0.43*	0.61*	0.44*
Use previous and current knowledge in many situations	0.63*	0.66*	0.71*
Fit my knowledge within a specific context/situation	0.60*	0.69*	0.72*
Apply my knowledge to individual situation	0.64*	0.72*	0.68*
Build my confidence in using my knowledge	0.68*	0.65*	0.66*
Make sound decisions using my knowledge	0.64*	0.68*	0.64*
Recognize the value of using knowledge in real action	0.61*	0.63*	0.59*
Reflect on my actual use of knowledge in a situation	0.63*	0.74*	0.68*
Enjoy getting feedback on how I use my knowledge	0.47*	0.62*	0.61*
Share the results of my knowledge use with others	0.49*	0.68*	0.46*

1   *Significant at 0.05 alpha level*
2