Cross-Cultural Adaptation of the Reformed Teaching Observation Protocol (RTOP): Establishing Linguistic Equivalency of the Arabic version

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Introduction

Many instruments developed and validated in English have been translated into different languages for measuring the variable of interest in different cultures. For example, Aldridge and Fraser (2000) translated "What Is Happening in this Class?" (WIHIC) questionnaire into Mandarin language to be used with students in Taiwan. Researchers translated the same questionnaire into different languages including Creole (Allen, 2003), Spanish (Allen, 2003; Soto-Rodriguez and Fraser, 2004), Indonesian (Margianti et al., 2004) and Korean (Kim et al., 2000). Dela et al. (2000) developed a version Measure of Acculation into Tagalog to be used in Philippine, Chin (2005) translated Test of Basic Scientific Literacy and the Test of Science-related Attitudes to Chineese to be used with science teachers in Taiwan, and Yalvac et al. (2007) adapted Views on Science–Technology–Society to be used in the Turkish context. Marshella (1978) suggested the method of description and measurement of any construct should be developed from the perspective of the cultures under investigation. However, the resources and time required to have representative researchers from all cultures involved may cause to be this impossible. This may explain why choosing an instrument to be translated or adapted and used for measuring variable(s) of interest which has been developed in another culture. Hambleton (1995) mentioned there are three reasons for translating or adapting instruments to be used in a different culture: a) to enhance fairness in assessment by allowing persons to be assessed in the language of their choice, b) to facilitate comparative studies across national, ethnic, and culture groups. For example, the International Association for the Evaluation of Educational Achievement (IEA) conducted Trends in International Mathematics and Science Study (TIMSS) in 2003 in more than 45 countries, which involved preparing mathematics and

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science tests in over 30 languages (Hambleton, 2005; Mullis, et al., 2007) and 50 countries participated in 2007 (Martin et al., 2008), and c) to reduce costs and save time in developing new tests.

Hambleton (2005) suggested that adaptation for an instrument is different from translation of the same instrument because it includes activities from deciding whether or not the instrument can be used to measure the same phenomena in a different culture, select translators, indentify modifications should be done according the target culture, and check for equivalency between source and translated version. Thus, translation of any instrument is only one step in the adaptation process and usually used when the target population has a different mother tongue but the cultural background is the same. However, it is unrealistic to assume that a simple application or literal translation is a valid option in cross-culture studies (Tanzer & Sim, 1999).

Unlike Translation, adapting a tool from one language to be used in another language associated with constraints due to the compromise combined with any translation process (Mumford et al. 1991). Thus in the adaptation process for a research tool into a target language, the distortion from the source culture needs to be reduced. A valid adaptation of a tool requires consideration of several dimensions of cross-cultural equivalence: content, semantic, technical, criterion and conceptual (Flaherty et al., 1988). For example, the Egyptian and the Saudi context have the same language but they are different in their culture. Thus instrument items using words or expressions related to the Egyptian students will not be convenient for their colleagues in Saudi Arabia.

For this reason, guidelines for translating educational and psychological instruments for use across different cultures have been developed by different institutions such as the International Test Commission (ITC). Some of the guidelines are related to how to properly translate tests and other assessment materials when measuring people who use different languages. For example, the standards state,

Instrument developers/publishers should insure that the adaptation process takes full account of linguistic and cultural differences among the populations for whom adapted versions of the test are intended…. Test developers/publishers should ensure that the data collection

design permits the use of appropriate statistical techniques to establish item equivalence between the different language versions of the test (Hambleton, 2001, p. 166).

Previous standards assume that inappropriate translation or adaptation procedures may lead to improper conclusions about variable(s) of interest cross different cultures (Bechger et al., 1999; Sireci, 1997; Van de Vijver et al., 1998). For example, Solano-Flores et al. (2001) find out using "and/or" can benefit native English speakers, but using "y/o" in the Spanish version can be confusing to native Spanish speakers. For this reason, validity of results in cross-culture science and mathematics education research depends on the quality of the translation or adaptation technique.

Reformed Teaching Observation Protocol (RTOP)

There are many efforts to bring different forms of reform to science and mathematics education in Egypt such as reforming science and mathematics teacher preparation program which involved three main steps: a) studying different models of teacher education program in different countries and standards for science and mathematics teacher preparation, b) developing performance and content standards for pre-service science and mathematics teacher, and c) defining content framework, and developing practicum. As a response for these efforts faculties of education changed the requirements, courses, methods of instruction, assessment of student learning, and monitoring the progress of student teachers to meet the new standards. New roles and demands are being placed on the science and mathematics teacher with the adoption of the Egyptian science and mathematics Education Standards. Thus traditional methodologies, in which "teachers tell, and students remember facts, theories, or procedures" (Lapadat, 2000, p.1), are not valued. Reforming teaching and learning science and mathematics is a movement from traditional methodologies toward constructivism (Adamson, et al., 2003; Piburn et al., 2000). Sawada (2002, p. 246) stated that "How would you know if a science or mathematics class was reformed?" This may explain the need for tool that can be used to assess the effect of science and mathematics reform in Egypt.

In 1995, the National Science Foundation (NSF) funded a collaborative project at Arizona State University called the Arizona Collaborative for Excellence in the Preparation of Teachers (ACEPT).

The Reformed Teaching Observation Protocol (RTOP) was designed by the Evaluation Facilitation Group of the Arizona Collaborative for Excellence in the Preparation of Teachers (Sawada et al., 2002). The Reformed Teaching Observation Protocol (RTOP) is an observational instrument that can be used to assess the degree to which science or mathematics instruction is reformed. Evaluation Facilitation Group depended on previous projects in developing RTOP such as Curriculum and Evaluation Standards (1989), Professional Teaching Standards (1991), and Assessment Standards (1995) established by National Council for the Teaching of Mathematics (NCTM), National Science Education Standards (1995) established by National Academy of Science, National Research Council, and Science for All Americans(1990), Benchmarks for Scientific Literacy (1993) developed by American Association for the Advancement of Science (Sawada et al., 2000).

RTOP consists of twenty-five items, with each rated on a scale from 0 (not observed) to 4 (very descriptive). Thus, a maximum score of 100 is possible. RTOP consists of three domains including: lesson design and implementation, content, and classroom culture. Content includes two sections: procedural & propositional knowledge and classroom culture includes two subsections "classroom communications and student–teacher relations". The target instrument can be described as follows:

Lesson design and implementation

This section consists of five items (1-5) focusing on respecting ideas that students bring to the classroom "students' prior knowledge and preconceptions", explore before formal presentation, encouraging students to use alternative modes of investigation, and use students' ideas to direct the lesson.

Content

This section includes two subsections "propositional and procedural knowledge". Propositional content knowledge consist of five items (6-10) which focus on the main ideas in science lesson, teacher's understanding of them, promote coherent understanding across topics, and the connections made with other disciplines and with students daily life. Procedural content knowledge consist of five items (11-15) which focus on the procedures that students follow in order to

manipulate data, make and test predictions, hypotheses, estimates, or conjectures, and solve problems.

Classroom culture

This section consists of ten items (16-25) and includes two subsections "classroom communications and student–teacher relations". In a reformed science classroom not only teachers speak and students listen but also student can talk to teacher or to each other (Newton et al., 1999). However, literature review revealed that student-to-student talk is rarely observed in classrooms environment (Wallace et al., 2002; Weiss et al., 2003; Wragg, 1993). Lemke (1990) suggested student-to-student interaction encourage students become fluent speakers so they are able to begin to make sense of their newly constructed ideas. Moreover, student questions, ideas, and comments are respected and taken into consideration so science or mathematics teacher is working as guide on the side to support and enhance students' investigations and active participation.

RTOP has been used in different studies to measure variable(s) of interest. For example, Martin & Hand (2009) used RTOP to describes the factors that affect an experienced teacher's attempt to shift her pedagogical practices in order to implement embedded elements of argument into her science classroom, Judson & Lawson (2007) used RTOP to test the hypothesis that constructivist teachers play an active role within teacher communication networks, Falconer et al. (2001) used it to measure the effect of reformed courses in physics and physical science on students conceptual understanding, Judson and Sawada (2001) used it to determine whether reformed science and mathematics courses at community colleges and universities were impacting education majors as they began a teaching career, and MacIsaac et al. (2001) used it as a catalyst for self reflective change in secondary science teaching.

Teachers found RTOP as a useful tool for lesson planning, professional development of new or student teachers, for their own personal pedagogical growth, and introduce the idea of reformed teaching to parents who may be familiar with traditional teaching (Maclssac & Falconer, 2002).

Many tools can be used to assess the degree to which science or mathematics instruction is reformed. However researchers selected the Reformed Teaching Observation Protocol (RTOP) because it is the

only instrument that meets the following criteria: a) focus on science and mathematics classes, b) aimed at classroom K-20, c) focused on reform rather than general characteristics such as opening, closure, transition, etc., d) brief to administer, e) studies used RTOP found it had a high intera-rater reliability, f) a high correlation with RTOP scores and science and math achievement, g) factor analyzed for construct validity, h) has a training and reference manual as recommended by International Test Commission (MacIsaac et al., 2001).

Translation techniques

Brislin (1970) offered four techniques for maintaining the equivalence between the original and translated instruments: a) back-translation technique; b) bilingual technique; c) committee approach; and d) pretest procedure.

Back translation is commonly used to check the accuracy of translation in cross-culture studies (Brislin, 1970). Three steps are involved in this technique: 1) a bilingual blindly translates an instrument from the original language to the target language, 2) another translator translates it back into the source language, and 3) The two versions of the instrument (original and back-translated version) are compared for meaning equivalence. The accuracy of the back-translated version is considered an indicator of the accuracy of the target translation (Douglas& Craig, 2007). When the last step reveals problems in meaning equivalence between the original and back translated version, another translator attempts to retranslate the instrument. This procedure continues until reaching meaning equivalence. The major weakness related to Brislin's classic translation model is that researchers cannot estimate how many independent bilingual translators are needed to get meaning equivalence between the original and the translated versions (Cha et al., 2007). Moreover, back translation does not necessarily ensure equivalence in meaning in each context. For example, Douglas and Craig (2007) suggested that since back translation provides a direct or literal translation from source to target language, it is possible to move from one version to another and back again without capturing the intended meaning. Harkness (2003) explained this situation using an example from a German social survey. "Das Leben in vollen Zügen geniessen" is an item in the survey. Literally, translated into English to be "Enjoy life in full trains". When this sentence is translated into

German again, it may produce exactly the same sentence as the original German, which would suggest that the translation was accurate. However, the more suitable translation into English would be "Live life to the full" or, in American English, "Live life to the fullest" Not "Enjoy life in full trains". Thus another technique may be needed to obtain appropriate translated instrument.

Bilingual translation has been advocated as a preferred technique to achieve equivalence in meaning. In this technique two versions of the instrument should be prepared in source and target language then both of them administrated to bilingual participants (Brislin, 1970). Participants' responses to the two versions are compared. When differences in participants' responses are identified, the researcher should review items that have discrepancy. Since bilingual do not use languages in the same way as monolingual participants because they are fluent in both languages, their responses may be different from monolingual population (Sperber et al., 1994).

Collaborative-based translation is a group of bilingual translates from the source to the target language (Brislin, 1970). There are two forms of collaborative-based translation: a) the committee approach, and b) the team approach. Committee approach requires bilingual expert science or mathematics educators to work together as a group while team approach requires several bilingual expert science or mathematics educators to make independent parallel translations of the same instrument. In the last case team of experts are required to work individually, more than a unit, if they are exist in different places. Meeting or virtual discussion is required to review and discuss differences between translation versions.

Pretest procedures: After the translation is completed, it is field tested to insure that target population will comprehend all questions (Brislin, 1970). The pilot study can reveal any problems of meaning equivalence between source and translated instrument. Qualitative and quantitative techniques can be used in pretest procedures. In qualitative technique the instrument can be administrated to a sample from the target population to get a feedback about their understanding of each item in the instrument. On the other hand, in quantitative technique two versions of the instrument administrated to a bilingual

sample of the target culture, and the differences in responses are compared.

Factors affecting quality of translation

Validity of results in cross-culture studies in science and mathematics education may be affected by quality of translation or adaptation process which can be affected by several factors. Brislin (1970) observed that the quality of translation depends on the language into which bilingual asked to translate. For example, translation to Chamorro is better than translation to Palauan, and French can provide better translation than German. Moreover, Cha et al. (2007) stated that source language can affect translation quality. Equivalence can be achieved when words in source instrument are clear. Also, the content can affect translation quality like translation of piece of art is easier than translation of passage about religion. Realistic problems which are related to a specific context should be reorganized to adapt the target language. The International Test Commission (ITC) standards state that:

> Effects of cultural differences that are not relevant or important to the main purposes of the study should be minimized as much as possible between the different language versions of the test (Hambleton, 2001, p. 165).

Science process skills which created by Enger and Yager (2001) was translated into Arabic language by the second author (in press) to be used with students in Egypt. Egyptian students were not familiar with English units such as inch, mile, and temperature on Fahrenheit scale used in the test, so they replaced with metric units such as cm, km, and temperature on Celsius scale.

Literature review revealed that one of the most important factors that may affect translation quality is quality of translators. Hambleton, Sireci, and Robin (1999) suggested that translators should be proficient with respect to principles of good item writing. Hambleton (2001) also stated that be fully proficient in both source and target languages, be familiar with the cultures associated with the different language groups, and at least general knowledge of the subject matter and testing principles has become part of the selection criteria for translators. Brislin (1970) suggested some rules which may help researchers to avoid factors that may affecting translation quality and achieve equivalence in meaning such as using simple sentences, avoid

detailed description, active voices instead of passive voices, nouns rather than pronouns, avoiding colloquialisms, decentering, and using proficient translators and independent.

Translation technique used in this study

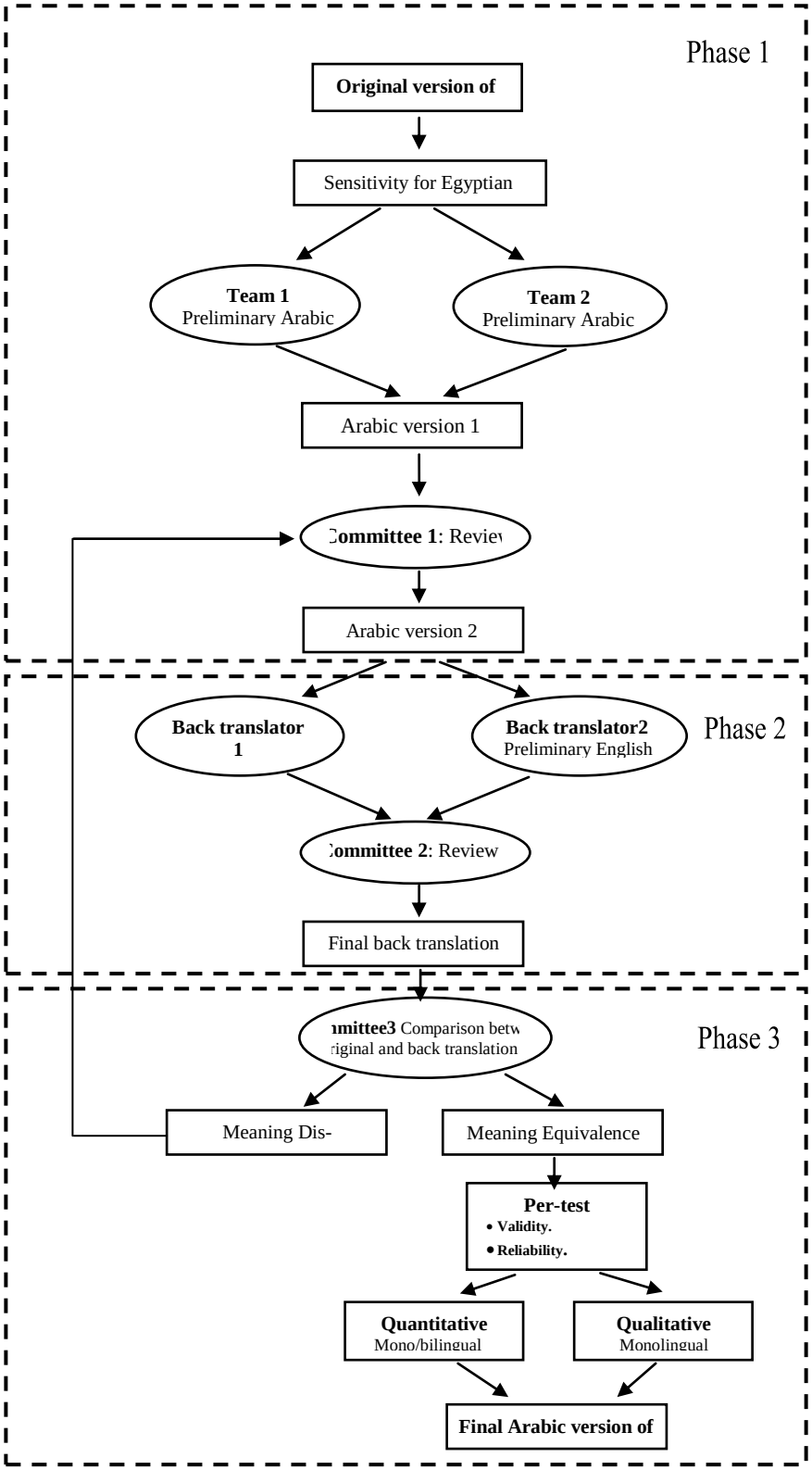
A combined translation technique was used in this study to develop an Arabic version of RTOP. This technique consisted of forward translation in conjunction with back-translation method, the committee approach and the pretest procedure using monolingual and bilingual participants as illustrated in Fig.1.

First phase aimed to prepare initial version of RTOP in Arabic language "version 2". Thus the relevance and sensitivity of the RTOP for Egyptian context were established through discussion with two bilingual science educators. Moreover, two pairs of translators worked as two independent teams to translate RTOP from the source language "English" to the target language "Arabic". Within each pair of translators there was a discussion to resolve inconsistencies. Team (1) consisted of two science educators who are proficient in source and target languages, familiar with the Egyptian cultures, and familiar with knowledge of the subject matter and testing principles as recommended by Hambleton (2001). Team (2) consisted of two persons with similar qualifications one of them is a science educator and the other is a mathematics educator. All four translators participated in translation of several research tools before, and had experience with effective item writing as recommended by Hambleton et al. (1999). A further round of review was needed to ensure that the source and the target version accurately capture the same meaning. For this reason, a review meeting "committee 1" held with two translators and an independent reviewer to resolve inconsistencies.

Second phase aimed to retranslate the Arabic version of RTOP into English language again "Back translation". Two independent back translators retranslated the instrument from the target language "Arabic" to the source language "English". A review meeting held with one translator and an independent reviewer to review the final back translation of RTOP.

Third phase In this stage monolingual English speaking with background in science education and a monolingual Arabic speaking

with background in English as a second language asked to check equivalence in meaning between source instrument and its back translation. Conceptual rather than literal meaning was the focus of this step. Problems in conceptual equivalence between original and back translated version were referred back to the committee (1) to be incorporated into the final version of the instrument. After the researchers and translators arrived at what is believed to be an adaptation for the target instrument according to Egyptian context, the next step was to pretest the Arabic version of RTOP in the target culture.


Phase 1
Original version of
Sensitivity for Egyptian
Team 1
Preliminary Arabic
Team 2
Preliminary Arabic
Arabic version 1
Committee 1: Review
Arabic version 2
Phase 2
Back translator 1
Back translator2
Preliminary English
Committee 2: Review
Final back translation
Phase 3
mittee3 Comparison betw
riginal and back translation
Meaning Dis-
Meaning Equivalence
Per-test
Validity.
Reliability.
Quantitative
Mono/bilingual
Qualitative
Monolingual
Final Arabic version of

The purpose of the pretest was to know do the actual respondents will comprehend all items in the instrument as the translators. Thus a pilot study was conducted to assess the appropriateness of the translated instrument. Qualitative and quantitative techniques were used in pretest procedures. In qualitative technique the instrument was administrated to a sample from the target population consisted of (15) monolingual student teachers to get a feedback about their understanding of each item in the instrument. On the other hand, in quantitative technique Arabic and English versions of the instrument administrated to bilingual sample and Arabic version was administrated to monolingual sample of the target culture, and the differences in responses were compared.

Method

Procedures

Literature review revealed that developing an instrument to be used in cross-cultural research involves more than merely translating (Bracken & Barona, 1991; Brislin, 1980, 1986; Geisinger, 1994; Hambleton & Bollwark, 1991; Hambleton & Patsula, 1998). However, the most common procedure for developing an instrument is to translate an existing instrument from the source language to target languages (Tanzer, 1999). In other words, culture validity have been neglected or inadequately addressed by current assessment practices (Solano-Flores et al., 2001).

In practice, however, translation procedures rarely are seen as part of instrument design and usually are treated as an addendum. For this reason, translation procedures should be integrated into the study design (Harkness, 2001).

In this study, number of procedures was used to adapt RTOP in Arabic language, as illustrated in Fig.1, including: a) check the relevance and sensitivity of the RTOP for Egyptian context were established through discussion with two bilingual science educators, b) translate the target instrument from English to Arabic language "version#1", c) review the initial translation and doing modifications "version#2", d) prepare back translation of the target instrument, e) review the back translation and doing modifications, f) check equivalence in meaning between source instrument and its back translation, g) pretest the Arabic version of RTOP in the target culture "qualitative & quantitative"

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Participants

This study used a sample of pre-service science teachers who were studying in the final year in Curriculum & Methodology department in their pre-service program. The faculty is not far from the downtown area of Alexandria University in Egypt; therefore it draws students from all parts of the city. However, 15 student teachers participated in the qualitative part, 8 student teachers participated in the quantitative part. The first group was asked to give feedback about their understanding for each item in the Arabic version of RTOP and to identify words or expression inconsistent with their experience. The second group was asked to observe 4 expert science teachers using Arabic version of RTOP.

Results

The English version of the RTOP was translated into Arabic and reviewed by bilingual science educators and then back translated into English by independent translators as recommended by Brislin (1970). Comparison between back translation and original version of the RTOP revealed that,

- In some cases, the language used in the back translations was simpler than that one used in the original English version. For example, Item 5 in the original English version "**The focus and direction of the lesson was often determined by ideas originating with students.**" and this was changed in back translation to be "**Learners' ideas often determine direction of the lesson**".
- Some key words in the original instrument had no direct equivalent in Arabic language. For example the term "triggered" in the original item "The teacher's questions triggered divergent modes of thinking" has no direct equivalent word in Arabic. Translators used a different word to give the same meaning in Arabic so when it translated again into English "back translation" it became "generated" instead of "triggered".
- Revision done by bilingual science and mathematics educators native speakers revealed that there is no significant difference in terms of conceptual equivalence between the original and back translation version.

On the other hand, revision of the Arabic version by committee (1) revealed that a number of instances where clarification of the meaning in the English version of RTOP were required. For example, idiosyncrasy specific to a particular culture such as local idioms were detected and during the early stages of the translation then replaced with others from the target culture, and hence, maximizing linguistic and cultural decentering (Tanzer & Sim, 1999; Van de Vijver & Poortinga, 2005). To achieve conceptual equivalence, translators and committee found out some modifications were necessary to be done such as:

- The passive tense is common in Arabic language so some items in the original version changed from active tense in English to be passive tense in Arabic.
- Egyptian students were not familiar with Arabic numbers (1, 2, 3, … etc.), so Indian numbers (1, 2, 3, …etc.) were used instead of Arabic numbers.
- Circle the right answer is not common in Egyptian context, so the Arabic version asked the target sample to use check mark.
- Egyptian student teachers were not familiar with some terms related to US context such as "solid grasp", so they replaced with other words had the same meaning.
- Direct translation for some words has no meaning in Egyptian context. In this case the translators selected other words has the same meaning and effect such as the term respected in the original item "The instructional strategies and activities respected students' prior knowledge …. Therein" replaced with the term addressed.
- Since the term preconception and prior knowledge in the original item "The instructional strategies and activities respected students' prior knowledge and the preconceptions inherent therein" has the same meaning in Arabic, the translators and the reviewers used different expression has the meaning "daily life experience" instead of preconception.
- Some words in the original version were replaced by two or three words to keep the same meaning such as preconceptions and triggered.
- The word students were replaced by learners which is more convenient for the Egyptian context.

Once the modifications were done by the reviewers and the process was repeated to ensure that the changes were adequate, the adapted instrument became ready for the field test.

Validity

Monolingual and bilingual participants participated in this phase. Four science and mathematics educators and 15 student teachers were asked to give feedback about their understanding for each item in the Arabic version of RTOP and to identify words or expression inconsistent with their experience. This step revealed some words which used in the original version has no meaning when they translated to Arabic. Thus, items with problems are referred back to the committee 1 to review and suggest alternatives then tested again with a sample of student teachers from the target culture.

Reliability

Previous studies used the RTOP instrument have found a high correlation with these scores and science and math achievement (Lawson et al., 2002; MacIsaac and Falconer, 2002). Estimated reliability for the RTOP has been previously reported as r^2=0.954 (Sawada et al., 2000).

The initial version of the questionnaire can be pretested on monolingual or bilingual respondents. Pretesting, followed by debriefing, can find problems of comprehension or meaning that were not identified previously. Issues identified in pretesting are referred back to the committee to be incorporated into the final version of the questionnaire. Without this step, there would be no way to know how actual respondents (versus translators) will react to the instrument.

Discussion

Literature review revealed that however, forward translation has been used for a long time in cross-culture studies, Brislin (1970) recommended forward translation in conjunction with back translation as a combined technique to check translation accuracy. Since forward and back translation can provide researchers with literal translation (Merenda, 2005) and do not help researchers to avoid culture decentering, at the same time using bilingual subjects alone to check appropriateness of translation is inadequate because they do not use language in the same way as monolingual (Sperber et al., 1994), a combined translation technique of forward translation in conjunction with back translation, collaborative translation, and qualitative &

quantitative pre-test was used in this study as recommended by several studies (Harkness et al., 2003; John et al., 2006; Cha et al., 2007) to achieve meaning and cultural equivalence.

Without accurate comparisons for scores in different cultures, the results of the research may not be valid. Based on this idea, when an instrument is used to measure the variable of interest in two different cultures, the items must be linguistically and psychometrically equivalent to promote a valid score comparison. In other words:

> How do we know we are studying the same phenomena in different contexts; how do we know that our observations and conclusions do not actually refer to "quite different things" which we unjustifiably include in the same conceptual categories? (Nowak, 1976, 105).

To achieve meaning and cultural equivalence, researchers may find some modifications are necessary to be done. According to the amount of changes to be carried out, Tazner and Sim (1999) distinguished between four levels of modifications: a) **Application**; if the target and the original populations have the same cultural and linguistic background, the instrument can be applied without any modifications, b) **Translation**; this option usually used when the target population have a different mother tongue but the cultural background is the same, c) **Adaptation**, in this option some modifications should be done according to the target culture. For example, some instruments contain expressions and/or examples related to the local culture which must be replaced by other expressions and examples from the target culture, and d) **Assembly**, in this case, many modifications should be done to the original instrument that, practically speaking, a new instrument is created.

The following example comes from an investigation examines how culture influences the way in which participants respond to a survey instrument.

> In the Euro barometer, which measures social and political attitudes in the European Union, the French and English scales differ in structure and, to a lesser extent, in semantics. Both uses the semantic dimension of agree, but in the French scale, the use of *d'accord*/*pas d'accord*

> suggests a unipolar scale, whereas the English scale uses a bipolar construction in which the wording is linguistically symmetrical with the endpoints modified by "strongly." Equally, the "do-not know" category is "cannot choose" in English compared with *ne sais pas* or "do not know" in French (Douglas & Craig, 2007, 37).

Douglas and Craig experience provide an example that shows how disregarding culture background may lead to misinterpretations. Transporting of instruments from one culture to another is the most dangerous practices in the educational and psychological assessment during the last half century, which continues to the present days (Merenda, 2005). Solano-Flores et al. (2001) mentioned that culture validity have been neglected or inadequately addressed by current assessment practices. Tanzer and sim (1999) observed that translating the original instrument from the source language to target languages is the most common procedure in cross-culture studies. In other words, most cross-culture studies in science education can be classified into the second category "translation". However, this study can be classified in the third category "adaptation". Thus some modifications were necessary to keep the meaning of the original version of RTOP. Those modifications can be classified according to sort of equivalence needed: a) vocabulary equivalence, some words in the original instrument had no direct meaning in Arabic therefore reviewers used other word(s) to keep the original meaning, b) Grammatical-syntactical equivalence, in some cases, translated items was simpler than in the original English version, c) Idiomatic equivalence, idioms related to US culture replaced with expressions more appropriate to the Egyptian context.

Conclusion

Since there is no perfect technique in translation, using forward translation in conjunction with back-translation method, the team or committee approach and the pretest procedure using monolingual and bilingual participants was found to be useful in this study. Literature review revealed that collaborative work in translation, review, and pretest is necessary for translation or adaptation. Five steps were determined for collaborative-based approach: a) translation, b) review, c) adjudication, d) pretesting, and e) documentation. Douglas and Craig (2007) suggested documenting translation procedures is desirable when the questionnaire is likely to be repeated annual or semiannual.

What is already known about this topic

- Translation or adaptation of an existing instrument into another language is cheaper and faster than developing a new instrument.
- Translation/adaptation quality may affect validity of results in cross-culture studies.
- Several translation/adaptation techniques have been created to maintain the meaning equivalence between source and target culture.

What this paper adds

- There is a need for consensus among science and mathematics educators on how to adapt an

To promote a valid comparison between respondents from different cultures, the instrument must be as linguistically and psychometrically similar as possible. The validity of results in cross-culture science and math education research depends on the quality of the translation or adaptation process. For this reason, there is a need for consensus among science and mathematics educators on how to translate or adapt an instrument, which is validated in source culture, to be used in a different culture. Moreover, studies used translated or adapted instrument(s) should provide information about the translation or adaptation process. In other words, translation or adaptation procedures should be integrated into the study design.

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Appendix

بطاقة ملاحظة الأداء التدريسي المطور RTOP

أولاً - بيانات عامة:

- اسم المعلم : .....

- الصف الدراسي : ..... - عدد سنوات الخبرة : .....

- المدرسة : ..... - الفصل المدرسي : .....

- المرحلة الدراسية : ..... - المادة الدراسية: .....

- اسم الملاحظ : ..... - تاريخ الملاحظة : .....

- توقيت بدء الملاحظة : ..... - توقيت انتهاء الملاحظة : .....

ثانياً - وصف السياق التعليمي والأنشطة :

عزيزي الملاحظ .....

تهدف بطاقة الملاحظة التي بين يديك إلى الوقوف على جودة الأداء التدريسي للمعلم؛ لذا يرجى إعطاء وصف مختصر لأحداث سير الدرس موضوع الملاحظة ، وحال الصف (المساحة – التنظيم .... الخ) الذي يحدث فيه الدرس، فضلاً عن أية تفصيلات أخرى ذات صلة بالمتعلمين (العدد – الجنس – العرق)، أو ذات صلة بالمعلم، وذلك في الجدول التالي المخصص لذلك. وجدير بالذكر أنه بإمكانك استخدام الرسوم التخطيطية إذا تطلب الأمر ذلك ، على أن تسجل الملاحظات في أثناء سير الدرس قدر المستطاع .

عزيزي الملاحظ .....

سجل أحداث سير الدرس في المساحة الجدولية التالية .

التوقيت	وصف أحداث سير الدرس

ثالثاً – تصميم الدرس ، وتنفيذه :						
م	المفـردة	لم يحدث				يحدث دائماً
1	صُممت الاستراتيجيات، والأنشطة التدريسية آخذه في اعتبارها معرفة المتعلمين القبلية ، وتصوراتهم المسبقة.	٠	١	٢	٣	٤
2	صُمم الدرس؛ بحيث يسمح للمتعلمين بالمشاركة بوصفهم أعضاء في مجتمع التعلم.	٠	١	٢	٣	٤
3	اتيحت الفرصة للطلاب لاستكشاف المعرفة المتضمنة فيه بالدرس قبل عرض المعلم لها.	٠	١	٢	٣	٤
4	شجع الدرس المتعلمين على البحث عن عملية ايجاد طرق بديلة للتحري ، وحل المشكلات وتقديرها.	٠	١	٢	٣	٤
5	غالباً ما يُوجه سير الدرس ، وبؤرة اهتمامه وفقا لأفكار المتعلمين.	٠	١	٢	٣	٤
رابعاً – المحتوى :						
١.٤ – المعرفة المفاهيمية:						
١.	يتضمن الدرس المفاهيم الأساسية في المادة الدراسية.	٠	١	٢	٣	٤
٢.	يُسهم الدرس في استيعاب المتعلمين المفاهيم بصورة مترابطة وواضحة.	٠	١	٢	٣	٤
٣.	يمتلك المعلم فهماً جيداً لمحتوى المادة العلمية المتضمنة في الدرس.	٠	١	٢	٣	٤
٤.	استخدمت عناصر التجريد (مثل التمثيل الرمزي وبناء النظرية) عندما تطلب الأمر ذلك.	٠	١	٢	٣	٤
٥.	تم استكشاف وتقدير الترابط مع المواد الدراسية الأخرى أو ظواهر من حياة المتعلمين اليومية.	٠	١	٢	٣	٤
٢.٤ – المعرفة الإجرائية:						
٦.	استخدم المتعلمون وسائل متنوعة (مثل : نماذج ، رسومات ، مخططات ، أشياء مادية ، مواد يدوية وغيرها) ؛ لتمثيل الظاهرة موضع الدراسة.	٠	١	٢	٣	٤
٧.	يقوم المتعلمون خلال الدرس بعمل تنبؤات أو تخمينات أو فرض فروض ، واقتراح أساليب لاختبارها.	٠	١	٢	٣	٤
٨.	يمارس المتعلمين مهارات التفكير الناقد حول الإجراءات المتبعة لفحص ظاهرة ما.	٠	١	٢	٣	٤
٩.	يتأمل المتعلمون ذاتياً في تعلمهم.	٠	١	٢	٣	٤
١٠.	شُجع المتعلمين على مواجهه بعض المواقف التي تتحدى قدراتهم العقلية وتقديرها، وممارسة النقد البناء حولها.	٠	١	٢	٣	٤

خامساً – ثقافة الصف :						
١.٥ – التفاعلات التواصلية :						
م	المفردة	لم يحدث				يحدث دائماً
١	يتواصل المتعلمون مع أقرانهم بأساليب ، ووسائط متنوعة لمناقشة ما لديهم من أفكار، وتبادلها.	٠	١	٢	٣	٤
٢	تستهدف أسئلة المعلم أنماط التفكير التباعدي لدى طلابه.	٠	١	٢	٣	٤
٣	أتيحت الفرصة للمتعلمين للتحدث؛ بحيث كان معظم هذا التحدث بين المتعلمين وبعضهم البعض.	٠	١	٢	٣	٤
٤	تحدد أسئلة المتعلمين، وتعليقاتهم بؤرة الاهتمام في الدرس واتجاه سيرة أثناء الحصة في أغلب الأحيان.	٠	١	٢	٣	٤
٥	يتسم مناخ الصف بالهدوء والاحترام لما يقوله الآخرون.	٠	١	٢	٣	٤
٢.٥ – علاقات الطالب / المعلم :						
٦	لاقت مشاركة المتعلمين الفاعلة التشجيع والتقدير.	٠	١	٢	٣	٤
٧	شُجع المتعلمين على عمل تخمينات ، واقتراح استراتيجيات بديلة للحل ، وطرق لتفسير الأدلة المتاحة.	٠	١	٢	٣	٤
٨	اتسم المعلم بوجه عام بالصبر في تعامله مع المتعلمين .	٠	١	٢	٣	٤
٩	قام المعلم بدور الميسر للتعلم والموجه لمصادره، وعمل على دعم استقصاء المتعلمين والارتقاء به.	٠	١	٢	٣	٤
١٠	من السمات المميزة لأداء المعلم أنه كان مستمعاً جيداً.	٠	١	٢	٣	٤

سادساً ـ تعليقات أخرى :

عزيزي الملاحظ .....

إذ نشكرك على تعاونك يرجى التفضل بتسجيل أية ملاحظات أخرى عن سير الدرس :

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ملخص البحث

تهدف الترجمة – كنشاط إنساني– إلى التواصل بين الأفراد المنتمين إلى ثقافات مختلفة ؛ لتحقق بين الناطقين بلغات مختلفة ما يمكن أن تحققه اللغة الواحدة من تواصل للأفكار بين الناطقين بها. لذا فإن البعض يرى أن الترجمة هي فن لما تتسم به من لمحات ذاتية الصبغة. فقد يترجم أحد الباحثين نص ما ثم يقوم باحث آخر بترجمة نفس النص بصورة مقبولة أيضاً ؛ بحيث تعكس ترجمته حس أدبي ولغوي وحالة مزاجية مختلفة عن الباحث الأول. وعلى الجانب الآخر يرى البعض أن الترجمة هي علم وفن ومهارة ؛ فهي علم لأنها تتطلب معرفة والمام ببناء وتراكيب اللغتين المترجم منها Source Language، والمترجم إليها Target Language ، وهي فن – أيضاً – لأنها تتطلب مرونة لغوية لإعادة صياغة المعاني، وهو ما يعتمد بدوره على وعى الباحث بكلتا الثقافتين ، وأخيراً فهي مهارة لأنها تتضمن القدرة على تقديم ترجمة لمفردات قد لا يكون لها مقابل في الثقافة المترجم إليها، وهو ما يستدعي معرفة جيدة من الباحث بقواعد وتراكيب اللغتين.

وفي ظل الاهتمام المتزايد بالدراسات الدولية – مثل دراسة التوجهات الدولية في الرياضيات والعلوم TIMSS ، والبرنامج الدولي لتقييم الطلبة PISA ، والدراسة الدولية للتقدم في القراءة PIRLS ... إلخ– التي تتم في ثقافات متعددة استخدم كثير من الباحثين في دول مختلفة في ميدان تعليم العلوم والرياضيات أدوات مترجمة لقياس نفس المتغيرات ؛ ويرجع ذلك إلى أن عملية الترجمة تقلل من التكلفة والجهد الواقع على كاهل الباحثين لتطوير أدوات تقيس نفس المتغيرات. ليس هذا فحسب ، بل إنها تثري أدب المجال في الثقافة المستهدفة – وهي الثقافة المصرية بالبحث الحالي– بأدوات بحثية مضبوطة مترجمة أومعربة طورت واستخدمت في ثقافات أجنبية؛ الأمر الذي يعطي فرصة لإجراء دراسات مقارنة ؛ كنتيجة لتوافر أدوات بحثية مضبوطة وفقاً لثقافات مختلفة ،

وفي ذات الوقت فإنها تسمح بالمقارنة بين نفس المتغيرات – موضع الدراسة – في سياقات ثقافية مختلفة. فعلى سبيل المثال ، تُرجم استبيان ما الذي يحدث في هذا الفصل What Is Happening in this Class? (WIHIC) إلى أكثر من ١٠ لغات؛ لتعرف طبيعة التفاعلات الصفية التي تحدث داخل فصول العلوم والرياضيات كما ترجمت الأدوات – الاختبارات والاستبيانات وبطاقات الملاحظة– المستخدمة بدراسة الاتجاهات الدولية في العلوم والرياضيات TIMSSإلى أكثر من ٣٠ لغة ؛ حيث اشتركت أكثر من ٤٥ دولة في هذه الدراسة عام ٢٠٠٣ ، والذي زاد ليصل إلى ٥٠ دولة عام ٢٠٠٧.

وكنتيجة للاهتمام المتزايد من دول العالم بمثل هذا النوع من الدراسات الدولية والدراسات المقارنة، فقد عُنى البحث الحالى بالبحث في آليات ترجمة الأدوات البحثية من لغة إلى أخرى ؛ لضمان تحقيقها لأهدافها بكفاءة ؛ حيث يشير Sireci (١٩٩٧) إلى وجود عديد من الأمثلة التي تشير إلى وجود خلل في إجراءات الترجمة، والتي قد تقود إلى استنتاجات غير صحيحة لاسيما عند المقارنة بين متغيرات تنتمي إلى ثقافات مختلفة. فعلى سبيل المثال، توصلت دراسة .Solano-Flores etal (٢٠٠١) إلى أنه قد يكون من المناسب استخدام and/or في الثقافة الأمريكية ، إلا أنه عند ترجمتها إلى اللغة الأسبانية لتصبح "Y/O" لقياس نفس المتغيرات ، فإنها تصبح مربكة للمتعلمين في الثقافة المكسيكية.

في ضوء ما سبق هدف البحث الحالي إلى تطوير آلية لترجمة الأدوات البحثية من اللغة المصدر Source Language إلى اللغة المستهدفة مع الحفاظ على اتزان المعنى Meaning equivalence ، والاتزان الثقافي Culture equivalence بين الأداتين. وطبقت هذه الآلية في تعريب بطاقة ملاحظة الأداء التدريسي المطور Reformed Teaching Observation Protocol (RTOP) ، والتي تهدف إلى تعرف جودة الأداء التدريسي للمعلم. وتعد هذه الأداة أحد أبرز الأدوات البحثية، وأكثرها

استخداماً بالولايات المتحدة الأمريكية. وتتضمن الآلية المقترحة للتعريب ثلاث مراحل ؛ وهي :

- **المرحلة الأولى:** هدفت إلى إعداد صورة أولية من بطاقة ملاحظة الأداء التدريسي المطور RTOP باللغة العربية من خلال ترجمة الأداة المصدر Source tool بواسطة فريقين من الباحثين كل على حده؛ ولتحقيق ذلك بالبحث الحالي تكون الفريق الأول من اثنين من الباحثين[1] في ميدان التربية العلمية. وتكون الفريق الثاني من باحثين[2] ينتمي أحدهما إلى ميدان التربية العلمية، والآخر ينتمي إلى ميدان تعليم الرياضيات . وروعى عند اختيار أعضاء الفريقين أن يكون لهم خبرات سابقة في ميدان ترجمة الأدوات البحثية ، وعلى دراية بالثقافة الأمريكية Source culture، والثقافة المصرية Target culture . وتمت المقارنة بين النسختين المترجمتين من الأداة للوقوف على جوانب الاتفاق والاختلاف ثم محاولة الوصول إلى صورة أولية من الأداة المستهدفة باللغة العربية.
- **المرحلة الثانية :** هدفت إلى إعادة ترجمة الصورة الأولية للأداة البحثية من اللغة العربية إلى اللغة الإنجليزية فيما يعرف بالترجمة العكسية Back translation بواسطة المؤلفين، ثم تنظيم مفردات الأداة الأصلية في جدول؛ بحيث تقابل كل مفردة نظيرتها المترجمة عكسياً تمهيداً للمقارنة بينهما.
- **المرحلة الثالثة :** هدفت إلى إعداد صورة معربة من الأداة المصدر من خلال التأكد من اتزان المعنى، والاتزان الثقافي لكل مفردة من مفردات الأداة المترجمة "النسخة العربية" مع نظيرتها بالأداة المصدر"النسخة الإنجليزية".

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١ تكون الفريق الأول من أ.د. مدحت النمر أستاذ التربية العلمية بجامعة الإسكندرية ، و أ.د. هالة طليمات أستاذ التربية العلمية بجامعة دمنهور.

٢ تكون الفريق الثاني من المؤلفين.

٣ اشترك في هذه الخطوة أ.د. روبرت ياجر Robert Yager أستاذ ومدير مركز التربية العلمية بجامعة أيوا بالولايات المتحدة الأمريكية ، أ.د.. محمود الابياري أستاذ المناهج وطرق تدريس الرياضيات ، و د. مها الكومي مدرس المناهج وطرق تدريس اللغة الإنجليزية بكلية التربية – جامعة الإسكندرية.

وتحقق ذلك من خلال فحص مفردات الأداتين المصدر والمترجمة عكسياً؛ للتأكد من أن كل مفردة في الأداة المترجمة عكسياً لها نفس معنى ووظيفة المفردة في الأداة المصدر. وهو إذا ما تحقق ؛ فإنه يعني أن مفردات الأداة التي اشتقت منها الترجمة العكسية – وهو النسخة العربية من بطاقة ملاحظة الأداء التدريسي المطور RTOP – يحقق نفس معنى ووظيفة مفردات الأداة المصدر. وبالبحث الحالي تم الاعتماد على اثنين من الباحثين في المقارنة بين النسختين المصدر ، والمترجمة عكسياً أحدهما متخصص في مجال تعليم اللغة الإنجليزية لغير الناطقين بها ، والآخر متخصص في مجال التربية العلمية[٣]. ولضبط الأداة RTOP في ضوء الثقافة المصرية نوعياً عرضت مفرداتها على عينة عددها ١٥ طالب من الطلاب المعلمين في كلية التربية بجامعة الإسكندرية ؛ لتعرف مدى فهمهم لكل مفردة من تلك المفردات ثم فحصت استجاباتهم؛ للتأكد من أن لديهم فهم مشترك لهذه المفردات كما أن فهمهم يتسق مع معنى تلك المفردات ووظيفتها في الأداة المصدر. ولضبط الأداة كمياً طلب من عدد ٨ طلاب معلمين بالفرقة الرابعة في كلية التربية بجامعة الإسكندرية استخدام الأداة المترجمة – بعد تدريبهم عليها ، وتقسيمهم إلى أربع مجموعات– في ملاحظة الأداء التدريسي لأربعة من معلمي العلوم والرياضيات في أثناء برنامج التربية العملية في العام الجامعى ٢٠١١/ ٢٠١٢. وبحساب معامل الارتباط لكل من المجموعات الأربع أسفرت هذه الخطوة عن تراوح معامل الارتباط بين ٠.٧١ ، ٠.٨٦ ، وهو ما يشير إلى أن الأداة المعربة لها درجة عالية من الثبات.

وبهذا أسفر البحث الحالى عن آلية مقترحة لتعريب أدوات بحثية من اللغة المصدر إلى اللغة العربية، فضلاً عن تزويد أدب المجال بصورة معربة لإحدى الأدوات البحثية المستخدمة في ملاحظة الأداء التدريسي للمعلم ، وهي بطاقة ملاحظة الأداء التدريسي المطور للمعلمين RTOP.

Abstract:

Translation or adaptation of an existing instrument into another language is cheaper and faster than developing a new instrument. This may explain why many researchers in science and mathematics education translated or adapted instruments developed and validated in English into different languages for measuring the variable(s) of interest in different cultures. There is numerous examples show that inappropriate translation or adaptation procedures may lead to improper conclusions about variable(s) of interest cross different cultures (Bechger et al., 1999; Sireci, 1997; Van de Vijver et al., 1998). Quality of the translation or adaptation technique may affect validity of results in cross-culture studies in science and mathematics education. For this reason, this study aimed to discuss issues related to translation or adaptations techniques in cross-culture studies using data from pilot study aimed to adapt Reformed Teaching Observation Protocol (RTOP) in Arabic language to be used with science and mathematics teachers in Egypt. In this study, researchers used a combined technique involved forward translation in conjunction with back translation, team approach, and pre-test to achieve meaning and cultural equivalence. Based on the findings, some educational implications of interest for the cross-culture studies are discussed.

Key Words: Cross-culture studies, translation techniques, RTOP, back translation, collaborative translation.