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Needs analysis for specialized learner populations: Essential methodological improvements

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ABSTRACT

This study surveys the design, methods and procedures reported in needs analyses (NAs) conducted for specialized English learner populations in varying contexts over the last thirty years (1984–2014). While NA practice has evolved and undoubtedly improved over time, our survey identified several remaining shortcomings and a lack of consistency in the sources, the methods and the interactions between sources and methods that researchers use to gather data and interpret findings, problems which decrease their reliability and validity. To illustrate how methodological rigor in NA practice and reporting can be achieved, we detail the methods and procedure followed in a large-scale task-based NA conducted for non-native English speakers working at a national research institution in the USA. Based on the current NA and the findings of our methodological survey, we provide a set of practical recommendations that are intended to be adaptable for local contexts and useful to language program administrators, curriculum designers and teachers responsible for the design of ESP courses and programs.

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1. Introduction

Needs analysis (NA) has a strong tradition in the development of ESP programs (Brown, 2009; Basturkmen, 2013; Hyland, 2009). Indeed, a well-conducted NA can lead to courses designed to ensure that students will learn precisely what they need. Despite the centrality of NA to ESP course design, comparatively little attention has been paid to the practice of NA itself. Here, we will not recount the history of NA, which will already be familiar to readers of this journal and for which detailed accounts are available elsewhere (see, e.g., Hyland, 2009; Long, 2013a, 2015a; Norris, 2009). Instead, we survey the methodological characteristics of ESP NAs conducted over the past 30 years, and argue for the potential relevance of procedures developed in research on NA practice in task-based language teaching (TBLT). In addition to outlining methodological improvements to NA following TBLT principles, we argue that the consistent application of relevant techniques, adapted to local contexts, can improve the reliability and validity of NA practice. Such an improvement is essential for ESP learners who require a certain level of English proficiency to succeed in their chosen occupational or academic pursuits.

We begin with a methodological review of NAs conducted from 1984 to 2014 with learners of English who have occupational or academic communicative needs. Following this review, we describe the approach utilized in a recent large-scale

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NA conducted with non-native speakers (NNSs) of English who need to function in field-specific discourse domains at a large U.S. scientific research institution. Finally, we consider methods used in previous studies and those in the current large-scale NA and offer practical, step-by-step recommendations that can be adapted by language administrators, curriculum designers and teachers who must design and implement language for specific purposes programs and courses. Ultimately, the goal is to improve the methodological rigor and consistency of NA practice and reporting, as well as course design.

2. Background information

2.1. Needs analysis in task-based language teaching

While the identification of learner needs has its beginnings in ESP, both task-based researchers and ESP specialists argue that the use of *task* as the unit of organization and analysis in all phases of TBLT (genuine task-*based*, not task-*supported*, programs) has increased the theoretical and practical utility of NA (Long, 1985, 2005a, 2005b, 2013a, 2013b; Norris, 2009; Skehan, 1998; Van den Branden, 2006; Van den Branden, Bygate, & Norris, 2009). Among other reasons, scholars argue that *task* is a unit that is meaningful to domain experts, a unit around which to organize lessons whose obvious relevance is motivational for students, and a unit that is compatible with what is known about the psycholinguistics of how adults learn additional languages (Long, 2015b). That is, adult learners do not sequentially learn a language in isolated parts (e.g., words, target structures, functions), but rather, in a nonlinear fashion, as parts of complex mappings of groups of form-function relationships (Long & Crookes, 1992). The idea is that tasks provide an ideal context in which the need to link form and function arises naturally during communication.

Using task as the key unit of analysis, a thorough task-based NA draws on data gathered from multiple sources of information, using multiple methods, to inform course content. Long (2005b) summarizes and evaluates potential *sources* of information, *methods* of collecting that information, and *triangulation* of data obtained from the same source via different methods and using the same method to consult several sources (i.e., *source* × *method* interactions) to help validate the data obtained.

- ***Sources***: **Insider and outsider**
  Published and unpublished literature, learners, applied linguists, domain experts, triangulated sources
- ***Methods***: **Qualitative and quantitative**
  Expert and non-expert intuitions, interviews, questionnaire surveys, language audits, participant and non-participant observation, ethnographic methods, journals and logs, language proficiency and competency measures

To increase reliability and validity, data should ideally be collected from two or more sources using two or more methods. Although difficult in practice due to time and access constraints, consulting a stratified random sample, rather than a convenience or purposive sample,[1] increases the chances that findings will accurately reflect the needs of the larger population from which the sample is drawn. To identify valid tasks, consulting learners only – whether they are pre-experience, pre-service (e.g., international medical students) or in-service (e.g., medical residents) – is insufficient and unlikely to produce a reliable inventory of the tasks that are consistently required of them to function successfully on a daily basis in their target discourse domain. Rather, domain experts (e.g., experienced physicians) should be consulted to access insider knowledge of what successful performance in a specific job or occupation entails. Domain insiders, however, are not able to provide complete information as they are less likely to have accurate intuitions about the language required to perform successfully; for that, applied linguists and other ESP educators are better equipped and can analyze genuine discourse samples from the target domain(s).

However, it is important to consider the potential influence of English as a global lingua franca, especially in the context of international universities, and the native or non-native speaker (NS/NNS) status of domain insider sources on the language that is expected in different tasks. While English is spoken by more non-native than native speakers around the world, the traditional assumption continues to be that “good” English means a “standard” English variety spoken by native speakers (Mauranen, Hynninen, & Ranta, 2010). Despite a growing awareness and critical perspective of the distant native speaker norm among researchers and practitioners, the expectation that learners acquire a standard English variety remains pervasive (Jenkins, 2006). Thus, NA researchers and ESP specialists should be aware of any mismatches in expected target language use in data obtained from NS and NNS informants and critically consider the language expected in target tasks and outcomes.

Domain insider sources should ideally be investigated using two or more methods, both qualitative (e.g., interviews) and quantitative (e.g., questionnaire surveys), or inductive and deductive in nature (Berwick, 1989). For example, unstructured interviews or non-participant observation are qualitative, inductive procedures from which initial categories of needs emerge.

[1] A convenience sample consists of informants available and willing to participate, whereas a purposive sample is a group that the analyst deems to be 'typical'. In both cases, samples may not actually be representative of the target population. The ideal sampling procedure is a stratified random sample, in which each member of the population has an equal chance of being selected and proportionally represents each sub-group of interest (see Long, 2005a, pp. 34–35).

In fact, it is vital to deploy open-ended procedures first, such as unstructured interviews, so as not to preclude the possibility of discovering needs the needs analyst might not have considered. One important consideration, however, is that such interviews are labor-intensive, meaning that relatively few informants can be consulted in this manner. After unstructured interviews have been conducted, a quantitative, deductive instrument, such as a structured interview with pre-set categories or a questionnaire, which is a top-down procedure, can be employed to assess the generalizability of the initial findings to a larger sample or, in rare cases, the whole population. To facilitate extensive coverage, quantitative measures such as questionnaire surveys tend to use easily scored, closed items (true/false, multiple-choice, etc.). Effectively, these measures test the analyst's hypothesis that the needs reflected in the instrument are the relevant ones, the only remaining issue being their scope. Again, the "open before closed" sequencing of methods is as important as their selection among the many available methods.

Once target tasks (TTs) (e.g., serving breakfast, lunch, dinner and drinks) and target task types (TTTs) (e.g., serving food and beverages) are identified based on the results of the NA, course designers can proceed with the latter phases of creating the program, which involve deriving *pedagogic tasks* (PTs), or what learners and teachers actually *do* in the classroom; sequencing them based on task frequency, criticality, or complexity (see Long, 2015c; Robinson, 2005, 2007) to form the *task syllabus* for the group(s) of learners concerned; and finally, assessing learners' ability to perform the set of TTs identified by the original NA using task-based, criterion-reference performance tests (Brown & Hudson, 2002; Norris, 2009).

2.2. A survey of methodological practice in needs analysis

While the practice of NA has become increasingly sophisticated since the early days of target situation analysis in ESP research, researchers have noted that the majority of studies tend to report NA findings rather than discussing the reliability or validity of their methodology (Gilabert, 2005; Long, 2005a, 2005b)—a crucial step in interpreting the findings themselves. Although domain-specific matters are of interest to practitioners working within the same domain, methodological issues will be of interest to all. Given the lack of attention to NA methodology in previous reviews of the L2 NA literature (e.g., Berwick, 1984; West, 1994), an updated, comprehensive survey of reported NA methodology in ESP contexts is clearly warranted, not only to highlight strengths and weaknesses, but ultimately to improve overall methodological rigor and increase collective confidence in NA findings.

In the following sections, we review research published from 1984 to 2014, divided into earlier and later time periods (1984–1999; 2000–2014), in order to analyze its evolution and compare NAs published before and after researchers began to pay explicit attention to the methodological practice of NA itself (e.g., Long, 2005a). An initial literature search using relevant terms identified 39 published studies. Only those that described their methodology in some detail and that targeted the communication needs of ESP learners were included. Based on those criteria, six studies were excluded because learners were either native speakers of English (Crosling & Ward, 2002) or learners of various foreign languages for specific purposes, rather than ESP (Dlaska, 1999; Lehtonen & Karjalainen, 2008; Lepetit & Chichocki, 2002; Nunez Paris, 2003; Van Avermaet & Gysen, 2006 [2]). In total, 32 studies were included in the survey.

2.2.1. NA methodology: 1984–1999

Table 1 shows the target learner population, context, sources, methods, and triangulation of sources and/or methods reported in the NAs of ten studies conducted in the earlier time period. Details of methods reported in the original study are provided in the Table when available, but not all studies reported the same level of detail (e.g., sample size).

As Table 1 demonstrates, NAs in the 1980's and 1990's were conducted in a wide variety of contexts and in response to the needs of a wide variety of specialized learner groups. Seven out of ten studies were conducted in places where English is considered a foreign language (e.g., Indonesia and Taiwan) and three in the United States, where English is a dominant language. With the exception of one study conducted in an academic setting (Coleman, 1988), all those surveyed involved learners with specialized needs in a range of occupational domains, including business, domestic service, healthcare, hotels, oil, telecommunications, and science and technology.

Four studies employed qualitative methods, three followed a strictly quantitative approach, and three used a mixed-method design. With regard to sources consulted, a little over half of the studies (6) specified the total number of participants, although no study explicitly discussed its sampling procedure (e.g., use of a convenience, purposive or stratified random sample). All ten studies consulted domain insiders as a key source of information, but only four consulted both insider experts and outsiders, e.g., ESP teachers and applied linguists, who are usually more useful than domain experts when analyzing the language involved in the target tasks identified. Nine studies included learners as informants, of which four consulted pre-service, and five in-service, learners, the latter group being more likely to provide accurate information.

Of the six studies that used questionnaires, only two provided detailed information such as the number and type of items, e.g., Likert-scale or multiple-choice. Of the seven that used some form of interview, four specified whether those interviews were (un)structured or semi-structured, their length, and/or the medium in which they were conducted (face-to-face, via online chat or telephone). Only one study (Jasso-Aguilar, 1999, 2005) discussed utilizing open, inductive procedures before closed, deductive ones, and only two studies, Chia, Johnson, Chia, and Olive (1999) and Tarantino (1988), explicitly mentioned

[2] For its exceptional level of methodological detail, the reader is referred to Van Avermaet and Gysen (2006), who reported two large-scale NAs in Belgium conducted for Dutch NNS immigrants (1993) and FL learners (1999) sponsored by the Flemish Ministry of Education.

Table 1
NA methodology: 1984–1999.

Study	Target population	Context	Sources	Methods	Triangulation of sources and/or methods
Svendsen and Krebs (1984)	English NNS immigrant healthcare workers (US)	EOL/ ESP	i) Director of department ii) Supervisor iii) Entry-level worker iv) Audio-recorded dialog v) Written forms, procedures, & job training materials vi) Vocational English as a second language (VESL) teachers	i) Interviews ii) Non-participant onsite observation iii) Document analysis	- *Interviews*Director* - *Interviews*Supervisor* - *Interviews*Entry-level worker* - *Observation*Healthcare workers*
Coleman (1988)	English NNS students in large, state Indonesian university	EFL/ EAP	i) Administrators ii) Faculty iii) Students in Academic resource, Administrative, Teaching program, & Miscellaneous units iv) Official documents related to university organization	i) Interviews ii) Questionnaire survey 1: Undergraduate students (attitudes & language learning experience) iii) (Previous) Questionnaire survey 2: Teaching staff (attitudes) iv) Review of official documents	- *Interviews* Administrators* - *Interviews*Teaching staff* - *Questionnaire*Students* - *Questionnaire*Teaching staff*
Cumaranatunge (1988)	English NNS female Sri Lankan domestic aids in Kuwait	EFL/ ESP	i) Returning domestic aids ii) Current domestic aids ($N = 30$) iii) Employment agencies & employers iv) Government officials v) Airline staff; travel agents vi) Job advertisements	i) Questionnaires ii) Structured interviews iii) Informal interviews iv) Field study & participant observation v) Document review	- *Questionnaire*Current domestic aids* - *Structured interviews* Current & returning domestic aids* - *Structured interviews* Agencies & employers* - *Informal interviews*Gov officials* - *Informal interviews* Airline staff & travel agents* - *Observation*Domestic aids*
Ramani et al. (1988)	Advanced English NNS students of science & technology at the Indian Institute of Science	EFL (Eng is medium of instr-uction)/ESP	i) Students ii) Insider domain experts (e.g., scientists) iii) Outsider ESP specialists/teachers	i) Non-participant observation ii) Unstructured interviews iii) Introspection	- *Observations*Students* - *Interviews*Students* - *Interviews*Scientists* - *Introspection*Teachers*
Tarantino (1988)	English NNS Italian researchers & professors in Faculty of Sciences who use English for science and technology (EST)	EFL/ ESP	i) In-field EST users (i.e., scientists) ($N = 39$)	i) Questionnaire (= structured interview)	- *Questionnaire*EST users*

Jones (1991)	English NNS technical employees in telecommunica-tions (FRANCE TELECOM)	EFL/ ESP	i) Technical staff ($N = 400$)	i) Questionnaire (70 items, 4-option MC)	- *Questionnaire*Technical employees*
Holliday (1995)	English NNS national staff employees working in an oil company in the Middle East	EFL/ ESP	i) Management (Company Training Manager & Deputy Manager) ii) Supervisors iii) National employees	i) (Unstructured) interviews ii) Review of writing samples by national staff	- *Interviews*Management* - *Interviews*Supervisors* - *Interviews*Employees* - *Writing sample review* Employees*
Cameron (1998)	Incoming English NNS international graduate students in nurse-practitioner programs at University of Pennsylvania	EOL/ ESP	i) Division chairpersons in School of Nursing ($N = 4$) ii) Students ($N = 16$)	i) Interviews ii) Library research iii) Participant observation in workshop for nursing supervisors iv) Tape-recorded ethnographic observations in 4 clinical sites	- *Interviews*Chairpersons* - *Observation*Supervisors* - *Observation*Students*
Chia et al. (1999)	English NNS 1st-4th year students in medical college in Taiwan	EFL/ ESP	i) Students ($N = 349$) ii) Faculty ($N = 20$)	i) Questionnaire survey A-Students (23 items, 2-multi-option MC) ii) Questionnaire survey B-Faculty (16 items)	- *Questionnaire A*Students* - *Questionnaire B*Faculty*
Jasso-Aguilar (1999, 2005)	English NNS hotel maids in Waikiki, Hawaii	EOL/ ESP	i) Three NNS housekeepers ii) Various supervisors iii) Executive housekeeper iv) Human resources (HR) v) Task force meetings vi) Morning briefings vii) Housekeeping room viii) Documents	i) Participant observation ii) Unstructured interviews iii) Questionnaire iv) Document analysis	- *Observation*Maids* - *Interviews*Maids* - *Interviews* Supervisor* - *Interviews*Executive housekeeper* - *Interviews*HR* - *Questionnaire*Maids (completed with help of supervisor or assistant housekeeper)*

Note. NS, Native-speaking; NNS, Non-native speaking; EFL, English as a Foreign Language; EOL, English as an Official Language; ESP, English for Specific Purposes; EAP, English for Academic Purposes; MC, Multiple-choice.

pilot-testing their materials for data collection, although some (e.g., Jasso-Aguilar, 1999, 2005) acknowledged the importance of piloting questionnaires.

In terms of one of the most important influences on validity, seven studies triangulated several sources via the same method. For example, Svendsen and Krebs (1984) conducted interviews with three different sources (director, supervisor, entry-level workers) in a healthcare setting. In contrast, Jones (1991) consulted only one source (English NNS telecommunications staff), and did so via a questionnaire (a closed procedure), thereby decreasing the likely validity of the needs identified. Six studies triangulated their chosen methods by holding source(s) constant. For instance, Jasso-Aguilar (1999, 2005) used participant observation, interviews, and a questionnaire to collect data from staff on the communicative needs of hotel housekeepers.

Finally, only four studies reported *source* × *method* interactions by triangulating data obtained from the same source via different methods and using the same method to consult several sources. For example, Cumaranatunge (1988) consulted Sri Lankan domestic aids through various qualitative and quantitative methods (questionnaires, structured interviews, and participant observation) and conducted structured or informal interviews across both in-service and domain expert sources (e.g., domestic aids, agencies and employers, government officials). Similarly, Ramani, Chacko, Singh, and Glendinning (1988) employed non-participant observation and unstructured interviews with the same source (pre-service science and technology students) and conducted interviews across two sources (students and domain-expert scientists).

2.2.2. NA methodology: 2000–2014

Table 2 shows the target learner population, context, sources, methods, and triangulation of sources and/or methods reported in twenty-three studies published between 2000 and 2014. Again, the level of methodological detail reported varies by study (e.g., sample size) and is provided wherever possible in the Table.

It is clear that NA in the 21st century continues to be carried out in a wide variety of contexts in response to a variety of specialized learner needs, a trend that is bound to accelerate, given that English continues to be the lingua franca in many contexts worldwide. Nineteen studies of the twenty-three surveyed were conducted in EFL contexts (e.g., Turkey, Hong Kong, Catalonia) and four within an ESL context in the United States. A wide range of specialized occupational domains were targeted, including aviation, business, banking and accounting, education, healthcare, textile and clothing manufacturing, (civil and high-tech) engineering, journalism, law, mountaineering, service industries, and telecommunications, with one study (Huh, 2006) conducted in an EAP setting.

Unlike the earlier studies, the majority of these later studies (15) favored a mixed-methods design, employing both qualitative and quantitative methods, with only five studies using only qualitative, and three only quantitative methods. Almost all studies (19) specified the total number of participants, and two (Kassim & Ali, 2010; Sesek, 2007) explicitly discussed their sampling procedure—an improvement, but still a disappointing minority. All studies, with the exception of Chostelidou (2010), consulted domain insiders, but as in earlier studies, a little less than half (10) consulted both insiders and outsiders, such as ESP specialists. All but two studies (Kassim & Ali, 2010; Sullivan & Girginer, 2002) included learners among their informants, six of which consulted pre-service, fourteen in-service, and one study (Sesek, 2007) that consulted both pre- and in-service learners.

It is clear that later studies report more detail about the nature of their data-collection materials. Of the eighteen studies that employed questionnaires, a large majority (15) provided information on such matters as the total number and type of items. Of the twenty that used interviews, fourteen specified such details as whether they were (un)structured or semi-structured in nature, their length, and/or the medium in which they were conducted. However, few studies indicated the use of inductive procedures prior to (and in order to inform) deductive procedures (Gilabert, 2005; Huh, 2006; Wozniak, 2010), and only eight reported pilot-testing their materials.

In the latter period, it is encouraging that a little over half of the studies (12) triangulated sources, and over three quarters (17) triangulated methods. However, slightly less than half (9) reported true *source* × *method* interactions, reflecting the trend found in the earlier studies. Bosher and Smalkoski (2002) is one example in the minority that triangulated data from multiple sources and multiple methods. They interviewed three sources varying in domain expertise (students, faculty and nursing director) and used findings from a student questionnaire and non-participant observation to triangulate the interview data. Similarly, Gilabert (2005) triangulated sources and methods through structured and unstructured interviews with journalism company representatives, scholars, and journalists, and used questionnaires informed by the interviews, non-participant observation in newsrooms and offices, and analysis of documents, such as email messages, to round out interpretation of the data.

2.3. Summary of trends and weaknesses in NA methodology

In summary, the survey of NA studies conducted for ESP learner populations published over the last 30 years reveals some degree of inconsistency in methodology and reporting across studies. Nevertheless, similarities and differences between NAs conducted during the 'earlier' (1984–1999) and 'later' (2000–2014) time periods show a growing sophistication and awareness among researchers, albeit with certain methodological gaps that continue to limit the ability to obtain reliable and valid data crucial for informing ESP course design.

Encouraging aspects that characterize the majority of both early and later studies include the consultation of domain experts and frequent triangulation by sources or methods. Positive changes evident in later studies include more frequent use

Table 2
NA methodology: 2000–2014.

Study	Target population	Context	Sources	Methods	Triangulation of sources and/or methods
Edwards (2000)	Senior English NNS bankers in German Central Bank in Frankfurt	EFL/ ESP	i) Employer ii) NNS students in English course at bank	i) Informal interview ii) List of general questions (past learning experience & future objectives)	- *Interview*Employer* - *Questions*Students*
Frank (2000)	English NNS international student patients & NS health personnel in Southern Illinois (US)	EOL/ ESP	i) Staff of the Student Health Program ($N = 100$) ii) NNS students ($N = 123$)	i) Student questionnaire (16 Likert-scale items) ii) Staff questionnaire (30 Likert-scale items) iii) Small group follow-up staff interviews ($n = 7$; 2 questions) iv) Non-participant on-site observation of student/ staff interaction	- *Student questionnaire* Students* - *Staff questionnaire* Staff* - *Interviews*Staff* - *Observations*Students/staff*
Li So-mui and Mead (2000)	English NNS textile and clothing merchandisers employed by Hong Kong-based companies	EFL/ ESP	i) NNS graduates from two Hong Kong institutions (Group 1-$n = 130$; Group 2-$n = 20$) working in industry for 1 year ii) Workplace supervisors iii) Authentic samples of written correspondence	i) Questionnaire 1 (12 items) ii) Questionnaire 2 (36 items) iii) Follow-up semi-structured telephone interviews ($n = 18$ graduates; $n = 15$ supervisors; 15 semi-structured questions) iv) Discourse analysis v) Onsite observation	- *Questionnaire 1 & 2* Merchandisers* - *Interviews*Merchandisers* - *Interviews*Supervisors* - *Observation*Merchandisers*
Bosher and Smalkoski (2002)	1st year English NNS nursing students in Associate of Science programs in Minneapolis (US)	EOL/ ESP	i) Nursing program director ii) Faculty members ($N = 5$) iii) Nursing students ($N = 28$ students)	i) Interviews ($n = 5$ students) ii) Questionnaire iii) Non-participant on-site observation (lab & clinical performance)	- *Interviews*Director* - *Interviews*Faculty* - *Interviews*Students* - *Questionnaire*Students* - *Observations*Students*
Sullivan and Girginer (2002)	English NNS students in training to become pilots & air traffic controllers (ATC) in Civil Aviation school in Turkey	EFL/ ESP	i) Turkish pilots ($N = 25$) ii) Turkish ATC ($N = 25$)	i) Analysis of tape-recorded communication between pilots & ATC (9 h) ii) Non-participant onsite observation in airport tower iii) Questionnaires iv) Interviews ($n = 10$ pilots; $n = 10$ ATC)	- *Questionnaires*pilots* - *Questionnaires*ATC* - *Interviews*pilots* - *Interviews*ATC* - *Observation*ATC*
Pritchard and Nasr (2004)	English NNS engineering students in 2nd, 3rd, & 4th year at Egyptian College of Technology	EFL/ ESP	i) Experienced teachers (to inform target reading skills) ii) Engineering trainees/students	i) Reading comprehension skills checklist (RCSC) ($N = 212$ students; 24 items) ii) Review of related literature	- *Checklist*Students*
Chew (2005)	English NNS banking employees in four banks in Hong Kong	EFL/ ESP		i) 1 hour interviews ii) Questionnaires	- *Employees*Interviews* - *Employees*Questionnaires*

(*continued on next page*)

Table 2 (*continued*)

Study	Target population	Context	Sources	Methods	Triangulation of sources and/or methods
			i) Banking employees with 1.5 months - 6 years experience ($N = 16$)		
Gilabert (2005)	English NNS professional journalists in Catalonia, Spain	EFL/ ESP	i) Scholars (e.g., media distribution specialist) ($N = 3$) ii) Company representatives (e.g., Editor in Chief) ($N = 8$) iii) Journalists ($N = 11$)	i) Unstructured interviews ii) Structured interviews iii) Questionnaires ($N = 59$ companies) iv) Non-participant observation v) Document analysis	- *Unstructured interviews*Scholars* - *Unstructured interviews*Co. reps* - *Structured interviews*Journalists* - *Questionnaires** Journalists - *Observation** Journalists
Huh (2006)	English NNS Korean and Japanese business students in Hawai'i English Language Program (HELP)	EOL/ EAP	i) Korean business professionals ($N = 73$) (also previous learners of business English course)	i) Literature review on previous business English NAs ii) Semi-structured interviews conducted via online chat ($n = 5$) iii) Questionnaire (open & closed-ended)	- *Interviews*Business professionals* - *Questionnaires*Business professionals*
Cowling (2007)	English NNS year 1–3 employee trainees in large Japanese industrial firm	EFL/ ESP	i) Administrators (sales director, training staff) ii) English teachers ($N = 4$) iii) Trainees ($N = 60+$) iv) Senior employees	i) Unstructured interviews ii) Semi-structured interviews iii) Open-ended questionnaire (5 items) iv) Open-ended, structured questionnaire completed in class (60% returned; 6 items)	- *Unstructured interviews* Administrators* - *Semi-structured interviews*Teachers* - *Open-ended Questionnaire*Students* - *Open-ended/structured Questionnaire*Students with senior employee*
Hoekje (2007)	English NNS international medical graduates (IMGs) in US context	EOL/ ESP	i) Supervisors & training directors ii) IMGs iii) Medical residents iv) Patients v) Members of health care team vi) Course faculty	i) Interviews ii) Focus groups iii) Onsite observations iv) Review of videotaped & audiotaped authentic discourse v) Journals vi) Language samples	- *Interviews*Supervisors & training directors* - *Interviews*IMGs* - *Journals*IMGs* - *Focus groups*Residents* - *Language samples* Patients/Health care team/Faculty*
Sesek (2007)	Novice EFL teachers in Slovenia	EFL/ ESP	i) Trainee, novice, and experienced teachers ii) Headmasters	i) Classroom observations ($n = 48$) ii) Structured interviews ($n = 11$) iii) Case studies ($n = 3$ novice teachers) iv) Written reflections/ reports on school-based teaching practice ($n = 93$ reports)	- *Observations*Teachers* - *Interviews*Teachers* - *Interviews*Headmasters* - *Case studies*Novice Teachers* - *Reports*Trainee Teachers*
Kaewpet (2009)	English NNS Thai civil engineering students	EFL/ ESP	i) Employers ($n = 5$) ii) Civil engineers ($n = 5$)	i) Semi-structured interviews ($N = 25$; 8 questions with list of communicative events)	- *Interviews*Employers* - *Interviews*Engineers* - *Interviews*Engineering lecturers*

			iii) Civil engineering lecturers ($n = 5$) iv) Ex-civil engineering students of technical English course ($n = 5$) v) ESP teachers ($n = 5$)		- *Interviews*Former engineering students* - *Interviews*Teachers*
Chostelidou (2010)	English NNS accounting students in Greek tertiary education	EFL/ ESP	i) Students ($N = 395$)	i) Closed and open-ended questionnaire ii) Semi-structured interview ($n = 35$)	- *Questionnaire*Students* - *Interview*Students*
Evans (2010)	English NNS professionals in Hong Kong's four key service industries (e.g., trading and logistics; tourism)	EFL/ ESP	i) Business professionals in SARS ii) Assistant General Hotel Finance Manager iii) Travel agency employee	i) Questionnaire ($N = 2030$ business professionals) ii) Semi-structured interviews ($n = 93$ business professionals) iii) 2 case studies involving non-participant observation	- *Questionnaire*Business professionals* - *Interviews*Business professionals* - *Case study 1*Assistant manager* - *Case study 2*Travel employee*
Kassim and Ali (2010)	English NNS engineering students in East Coast region of Malaysia	EFL/ ESP	i) Engineers ($N = 65$) in 10 multinational chemical companies in Malaysia	i) Closed- and open-ended questionnaire (38 items)	- *Questionnaire*Engineers*
Lambert (2010)	NNS English majors at Japanese university	EFL/ ESP	i) Job placement records ii) NNS experienced informants in business & education ($N = 2$) iii) NNS graduates over 5-year period ($N = 28$) iv) NNS graduates over 25-yr period ($N = 198$)	i) Analysis of existing employment records ii) Unstructured interviews iii) Open-ended survey iv) Follow-up survey ($n = 7$ 5-year grads) v) Closed-ended survey (22 Likert-scale items)	- *Interviews*Business/Education experts* - *Open-ended survey*5-year grads* - *Follow-up survey*5-year grads* - *Closed-ended survey*25-yr grads*
Wozniak (2010)	English NNS French Mountain Guides at the French National Skiing/Mountaineering School	EFL/ ESP	i) NS experienced mountaineering guides ($N = 3$) ii) NNS novice guides (with three years training experience) ($N = 53$ novice guides)	i) Unstructured interviews (60 min each) ii) Closed- and open-ended questionnaires (37 questions) iii) Non-participant observation (EFL oral exam)	- *Interviews*Experienced guides* - *Questionnaire*Novice guides* - *Observation*Novice guides*
Xhaferi and Xhaferi (2011)	English NNS law students in Southeast European University (Macedonia)	EFL/ ESP	i) NNS law students of different ethnic backgrounds ii) NNS ESP instructors iii) NNS administrators	i) Closed-ended questionnaire (10 items; $N = 40$ students) ii) Structured interviews (6 items; $n = 8$ instructors; $n = 4$ administrators)	- *Questionnaire*Students* - *Interviews*Instructors* - *Interviews*Administrators*
Lockwood (2012)	English NNS Customer service representatives (CSRs) in Asian call centers (i.e., outsourcing sites in India, Phillipines)	EFL/ ESP	i) CSRs ii) Business stakeholders (Account managers, human resource office recruiters, communication quality assurance personnel)	i) Focus group interviews ii) Onsite observations (analysis of authentic calls)	- *Interviews*CSRs* - *Interviews*Business stakeholders* - *Observation*CSRs*
Evans (2013)	Same as Evans (2010)	EFL/ ESP	i) Accountant ii) Banker iii) Business professionals in private sector	i) 2 'week-in-the-life' case studies based on activities logs	- *Case study 1*Accountant* - *Case study 2*Banker* - *Interview*Accountant* - *Interview*Banker*

(*continued on next page*)

Table 2 (*continued*)

Study	Target population	Context	Sources	Methods	Triangulation of sources and/or methods
				ii) Semi-structured interviews iii) Likert-scale questionnaire ($N = 1478$ business professionals)	- *Questionnaire*Business professionals*
Mancho-Barés and Llurda (2013)	First-year Business English students in Catalan University in Barcelona, Spain	EFL/ ESP	i) Institutional foreign language policy ii) Business English students ($N = 129$) iii) Local business representatives from various sectors ($N = 6$)	i) Document analysis ii) Entry test (44 items) iii) Self-report (self-assessment & background experience) questionnaire iv) Focus-group discussion	- *Document analysis*University policy* - *Entry test*Students* - *Questionnaire*Students* - *Focus-group discussion*Business professionals*
Spence and Liu (2013)	Taiwanese high-tech English NNS process integration engineers (PIEs) working in multinational corporation	EFL/ ESP	i) PIEs ii) Long-term customer	i) Survey 1 (6 items; $n = 39$ PIEs) ii) Survey 2 (10 items; $n = 31$ PIEs) iii) Survey 3 (5 items; $n = 51$ PIEs) iv) Semi-structured interview (9 questions; $n = 11$ PIEs) v) Non-participant observation	- *Surveys*PIEs* - *Interview*PIEs* - *Interview*Customer* - *Observation*PIEs*

Note. NS, Native-speaking; NNS, Non-native speaking; EFL, English as a Foreign Language; EOL, English as an Official Language; ESP, English for Specific Purposes; EAP, English for Academic Purposes; MC, Multiple-choice.

of mixed-method designs employing both quantitative and qualitative methods, reporting of more information on participants and materials, and more frequent use of in-service rather than pre-service learners.

Less positive aspects of the studies include the almost complete lack of explanation of sampling procedures, including use of stratified random samples of target learner groups, use of procedures in the desirable order, from open to closed or from inductive to deductive, and a frequent failure to pilot-test data collection materials. The use of pilot-testing was reported more often in the later studies—36% as opposed to 20% in the earlier ones—yet remained a disappointing minority. As Long (2005b) argues, pilot-testing NA materials is crucial, particularly in the case of questionnaire items, to avoid irrelevant questions, double-barreled questions, overly complex and technical wording, leading questions, ambiguity, abstractness, and sensitive or threatening questions (p. 38).

Finally, less than half of the studies in each sample triangulated data from multiple sources by multiple methods to identify possible *source* × *method* interactions. This lack of triangulation is a significant weakness and confirms the criticism of Long, Gilabert and others that while most NAs for ESP programs involve data from different sources and/or data gathered via different methods, they rarely move beyond 'informal cross-checking' of identified discrepancies to attempts to explain them via triangulation.

3. Current study

3.1. A NA for a scientific research institution

Given the methodological shortcomings and lack of consistency in reporting across prior NA studies revealed by the survey, it is all the more important to raise awareness among researchers and practitioners of the necessity of ensuring that tasks identified by NA are really those required of learners to function successfully at work or other settings, and thus to suggest best practices in conducting NAs for specialized learner populations. To contribute to this effort, the aim of the current section is to exemplify practical methodological recommendations by describing a large-scale NA carried out for NNSs of English working in highly specialized domains at a national scientific research institution in the USA.

The NA was conducted by a faculty member (Long), together with M.A. and Ph.D. students from two different institutions who were enrolled in a 2010 TBLT seminar. The study was conducted at the request of the office responsible for training and educational opportunities at the institution concerned. The goal of the study was to assess the communicative English language needs of trainees working as international post-docs, visiting fellows, research fellows, and clinical fellows, and thereby to inform the design of ESP courses for these trainees.

3.2. NA criteria

From the outset, the research team paid particular attention to creating and implementing a methodologically sound NA. The NA thus employed both quantitative and qualitative methods, insider and outsider sources, extensive pilot testing of data collection materials, detailed reporting on the development and content of those materials, and triangulation of multiple sources and multiple methods. A brief overview of these methods and sources is described below, followed by a step-by-step consideration of the NA model utilized.

3.2.1. Sources

As argued previously, consulting (pre-service) learners as the sole source of information for NA development is insufficient. These learners are not likely to be well-informed about their present or future communicative needs, due to their lack of knowledge of the tasks they will be required to perform or of the language necessary to perform them. Insider knowledge from domain experts is a minimum requirement for validity. Therefore, we consulted several participant sources of information varying along three dimensions: insider/outsider, status/position, and English NS/NNS, with NNS participants reporting 14 total native languages, including Chinese (Mandarin), Korean, Japanese, Russian, Polish, Hungarian, German, Spanish, French and Portuguese. Insider sources of information included in-service learners (trainees) and domain experts (supervising Principal Investigators, or PIs) specializing in such fields as Biochemistry and Genetics, Biology (Developmental, Cell, Molecular), Neuroscience, Pathology (Ocular), Biophysics, Immunology/Infectious diseases, Physiology and Pharmacology. As noted earlier, a stratified random sample in which each member of the population has an equal chance of being selected is always preferable when possible. However, as is often the case, our participants were ultimately samples of convenience as informants who were available and willing to participate (i.e., conduct face-to-face interviews and complete online questionnaires as described below).

A team consisting of several graduate students in applied linguistics from the TBLT seminar and their professor (the third author, who had previously conducted a number of NAs in academic, occupational, and social survival settings) served as outsider sources with the relevant experience for developing and deploying the instrumentation and procedures.

3.2.2. Methods

Given the outsiders' lack of knowledge of the relevant categories of needs in these highly specialized discourse domains, the two main qualitative and quantitative methods employed were sequenced with the more 'open' procedure, a semi-structured interview, preceding the more 'closed' procedure, one of three on-line questionnaires designed for three

categories of respondents. Questions in the semi-structured interviews varied somewhat for PIs and NS and NNS trainees, but asked participants to focus on what they did (without using the term 'task') in a typical day at work and outside of work (in the trainees' case), and also asked participants about any activities they felt were affected by communicative problems, whether experienced as supervisors (PIs) or supervisees. The tape-recorded semi-structured interviews, completed by a convenience sample of six PI and 25 international post-doc volunteers, offered an inductive assessment of the categories of needs and relevant target tasks that could emerge from the study. The needs and tasks identified by participants informed the creation of three mostly closed-item questionnaires, which were then completed by a sample of 278 PIs and 860 NS and NNS trainees to establish the degree to which the original small sample reflected the perceived needs of the larger principal PI and post-doc population. Two additional methods were employed: non-participant observation in a lab setting, and analysis of digitally-recorded samples of language use in those labs. A special focus was a critically important weekly communicative event, the 'lab meeting,' when individuals reported on the work they had done since the last meeting, which was then discussed by the PI and others in the research group. Due to space limitations, we focus here only on the two principal qualitative and quantitative methods used.

3.2.3. Source × method interactions

The research team endeavored to ensure that different sources were investigated via the same method, that different methods were used to consult the same source, and that findings from distinct sources and methods were triangulated. This approach produced a more accurate picture of the language needs arising during a typical day or a typical week at work. To triangulate sources and methods, interviews and questionnaires were used to assess the frequency and difficulty of accomplishing and overseeing daily tasks from the perspective of in-service learners who could accurately describe their English language needs on the job, as well as domain experts who could report on the communication challenges they experienced as supervisors. Asking both PIs and trainees (separately) about perceived communication problems due to inadequate linguistic abilities revealed a significant gap between the perceptions of the two groups, with NNS post-docs often unaware of the reduction in their work effectiveness that their insufficient command of English was causing from the PIs' (usually very sympathetic) vantage-point. The communicative experiences of a sample of post-docs and research fellows who were NSs of English, collected through interviews and a modified version of the questionnaire tailored to them, also helped to distinguish problems genuinely caused by linguistic and cultural differences, as opposed to problems that both NSs and NNSs sometimes experienced that had nothing to do with language and culture, such as being assigned to research projects outside their area of specialization. These examples show how several sources (i.e., in-service learners/domain expert PIs, NS and NNS trainees) were consulted across multiple methods (i.e., interviews and questionnaires), thereby triangulating the data, to produce findings that would have been missed otherwise.

3.3. Design and procedure

Figure 1 lays out each step in the procedure used to carry out this particular study, presented here as a model that can be adapted for future NAs in different contexts.

Step 0: The office responsible for education and programming at the research institution observed that many of their in-service researchers were struggling with English in the workplace and contacted Long to request a NA with the eventual goal of informing the design of a new ESP course.

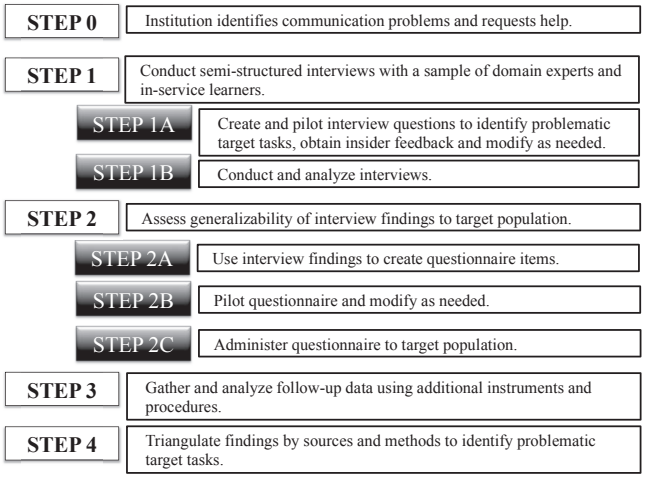

Figure 1. NA procedure.

Step 1: An open procedure was used to begin to identify the target tasks in-service learners were required to perform at the research institution and any (language and/or cultural) barriers to accomplishing those tasks. A team of student researchers—applied linguists with various language backgrounds—created interview questions, conducted and recorded semi-structured interviews with NS and NNS domain experts and in-service learners, and analyzed the interviews to identify categories of needs and problem areas.

Step 1A: The research team brainstormed several possible open-ended questions for the semi-structured interviews. Items ranged from warm-up questions to make interviewees feel more comfortable to content-based questions designed to identify specific tasks. The initial questions attempted to identify an interviewee's background, including language background, living circumstances, and experience with English (for the NNSs). Subsequent questions elicited information about the tasks post-docs needed to complete to be successful at work, including their perceived frequency, difficulty, importance, and the interviewees' level of enjoyment in completing the tasks. The final questions sought to identify tasks on which the NNSs' command of English had an impact. Through an iterative process, the questions were compiled, discussed, and revised. The resulting list was sent to senior staff at the training and education office at the research institution to obtain their feedback. After questions were reviewed and revised, a final list of nineteen questions was used in the post-doc interview protocol, and eleven in the PI/Supervisor protocol. Prior to data collection, members of the NA team completed a training session to learn each protocol, in which they reviewed the interview questions and procedures and had an opportunity to ask questions.

Step 1B: The research team interviewed a volunteer sample of six PIs and 25 international post-docs at the research institution, recruited by an email sent by the institutional contact. Whenever possible, the researchers interviewed the NNSs in their native language in order to put the interviewees at ease and gather the most accurate information possible. Post-docs were asked such questions as "*Can you describe a typical day at your institution?*" and "*What are the five most important things you do at your institution (on a daily basis)*?" These questions helped identify target tasks at work. Other questions asked about the people with whom they usually interacted on a daily basis and if they had encountered any problems in their work independent of, or due to, language difficulties. They were finally asked about their activities outside work to gauge any non-work areas of need, including such 'survival skill' tasks as obtaining a driver's license or setting up an internet/phone/TV connection. At this stage of the process, the aim was to identify a comprehensive list of the needs of the international post-docs both at work and in outside life domains. At the end of the NA, the needs were grouped into target tasks and target task-types for the larger group, with the understanding that only rarely can all needs be addressed in a given ESP program.

PIs, on the other hand, were typically asked such questions as "*What problems, if any, do you think graduate students or post-docs encounter?*" and "*Do you find they have problems with their English or other communication skills*?" (It would turn out that PIs sometimes perceived language problems unknown to international researchers in their labs, and vice versa.) The informal interviews lasted 20 minutes on average. They were transcribed and data were collated to create a list of reported target tasks at work and outside work, reported language difficulty in English, perceived cultural differences, and goals, in terms of language and culture. These findings (i.e., the target tasks identified in the interviews) were the basis of the questionnaire items in the next step.

Step 2: To determine which oral and written tasks emerged as the most problematic from the perspectives of the in-service learners and their supervisors, a questionnaire was created based on information gathered in Step 1B. Given the large number of respondents, a survey with open-ended responses could have produced unwieldy amounts of information with multiple possible interpretations, jeopardizing the reliability of the data collected via the questionnaire. For this reason, the questionnaire constituted a primarily "closed" procedure; categories were predetermined (based on the interviews) and there were few opportunities for respondents to expand on their answers.

Step 2A: Three versions of a questionnaire were generated based on preliminary findings from the collated interview data: one for NNS post-docs (38 questions), one for NS post-docs (12 questions), and one for PIs (23 questions). Survey Monkey software, (http://www.surveymonkey.com, last visited [September 30, 2014]), was used to create the survey instruments.

All questions were yes/no, multiple-choice or Likert-scale items probing background information (language background, use of English, and research area), frequency of English use in the workplace, frequency of target tasks, difficulty of target tasks, cultural differences, and personal goals for learning English. For example, NNS trainees were asked to indicate how frequently they conducted a particular task and how difficult they considered it to be (e.g., 'Write a lab report,' 'Give formal presentations in small group') by selecting the appropriate response on scales probing frequency: 1 – Never, 2 – Sometimes, 3 – Often, 4 – Very frequently, 5 – N/A; and difficulty: 1 – Easy, 2 – Difficult, 3 – Very difficult, 4 – N/A.

Step 2B: Before they were administered, the questionnaires passed through three main revision cycles targeting both insider/outsider perspectives in an effort to create a valid and reliable assessment tool.

(1) **Outsider/Insider review I**: Applied linguistics team of faculty member and doctoral students.
(2) **Insider review I:** Research institute insider(s) working at the office responsible for training and education.
(3) **Outsider review II:** Two linguistics doctoral graduate students unfamiliar with the project.

The research team first reviewed the content, format, feasibility, clarity, and relevance of the questions and answer options, based on their experiences interviewing participants. Team members were considered outsiders in terms of the professional domain, but partial insiders as well, from having gained access to insider perspectives during the interview process. Revision phase I resulted in several modifications to the questionnaires. Most revisions were related to (lack of)

clarity of wording, but some were designed to expand or reduce response options provided to participants and to decrease the number of open-ended questions overall, considering the large number of participants who would eventually respond to the questionnaires. This decision was also made based on Van Avermaet and Gysen's (2006) finding that data obtained from the closed-ended part of their questionnaire yielded the most useful results in terms of analysis and interpretation.

The team's main contact, an insider working at the office responsible for training and education, circulated the draft questionnaires among colleagues, who also prompted several changes, often to align wording with insider terminology or to provide generic categories for research areas, which in this case were quite diverse (e.g., Biochemistry and Genetics, Biophysics, Immunology/Infectious diseases). Finally, in order to assess clarity and response times required, two outsiders, applied linguistics graduate students unfamiliar with the project, piloted the survey by completing the three versions of the surveys online.

Step 2C: The electronic links to the final drafts of all three questionnaires were sent to 3,800 trainees and 1,200 PIs working at the research institute. The final version of the questionnaire for NNSs took about ten minutes to complete, and the versions for NSs and PIs about six minutes. Response rates were 23% (860/3,800) for trainees, 69% (596) of whom were NNSs and 31% (264) NSs, and 23% (278/1,200) for PIs. A response rate of 25%–30% is considered average for an email-based questionnaire without a follow-up email (Cook, Heath, & Thompson, 2000); thus, the response rates were slightly below average for an online questionnaire.

Step 3: Questionnaire findings sometimes suggest the need for follow-up, requiring a variety of additional procedures ranging from further interviews to the use of participant journals and activity logs. Whether such follow-up is desirable is typically indicated by disparities in the responses of different groups (sources) via the same method(s), or between responses from the same groups (sources) via different methods. Results also facilitate triangulation by sources and methods. In this case, the tools chosen to further elucidate findings were non-participant observation and analysis of discourse, the transcripts of recorded discourse samples from lab meetings (For a rationale and procedures for analysis of discourse in specialized domains, see Long, 2015d.)

Step 4. The final step was to analyze and triangulate the data collected via the in-service trainee and supervisor questionnaires to identify the most frequent, most important and most difficult target tasks that posed problems for the NNSs, and to triangulate that information with data obtained via other procedures implemented in Step 3. Given our focus on NA methodology, the results are not reported here, and at the request of the research institution, the results are not publicly available.

4. Limitations

The procedure described above is one that can facilitate more reliable identification of target tasks; however, the study was not without weaknesses and limitations. For example, the notion of target task criticality was subsumed under frequency and difficulty, rather than probed separately. This conflation can be remedied by having survey participants report on the relative importance of tasks using a Likert scale. Another area for improvement was the few opportunities for open-ended responses in the questionnaires. The decision to limit the number of open-ended responses on this measure was based on initial efforts to identify target task categories through open-ended interviews and the logistical feasibility of quantitative analysis, but open-ended responses are desirable whenever possible, as they can allow additional potentially relevant information to emerge. Additionally, the respondents in our study were samples of convenience, in this case volunteers, and thus not the ideal stratified random samples, so it is possible, for instance, that tentative hypotheses about problematic target tasks were biased by the individuals who volunteered to be interviewed. These individuals might have been especially aware of difficulties NNSs experienced in their labs. Similarly, the eventual response rate of 23% to the questionnaires is fairly typical of such surveys, raising potential questions about the representativeness of the information gathered. In this case, the large total number of respondents (over 1,100) may have reduced that danger to some extent.

5. Conclusion and methodological checklist

While learner needs identification is not a recent development in the field of applied linguistics, the comprehensive survey of NA studies conducted over the last 30 years (in Section 2, above) shows that common standards for reliability and validity have yet to be established. Achieving such standards requires consistent application of criteria for the use of methodological procedures, including triangulation of methods and sources. An example process approaching a desirable model was exemplified in a NA study as described in Section 3 above. Figure 2 offers a simple yet adaptable methodological checklist to guide the practice of conducting NAs for learners with specialized, domain-specific L2 needs.

At least two classes of adaptations to this framework may be required, depending on various factors—principally the quantity and quality of available resources. First, in the case of NAs for small groups and/or institutions, it may occasionally be possible to modify steps in the process towards greater comprehensiveness. For example, it is sometimes possible to conduct interviews or administer questionnaires to a whole population, not just a sample thereof. More often, however, adaptations will need to be in the opposite direction, towards greater simplicity and reduced scope. Although highly desirable, comprehensive NAs are often impossible, due to a variety of constraints, ranging from inadequate time, money or access to insiders to inadequate expertise on the part of the needs analysts themselves. The relatively rigorous approach to NA proposed here and depicted in Figure 1 might only be possible in resource-rich contexts with cooperating insiders, most

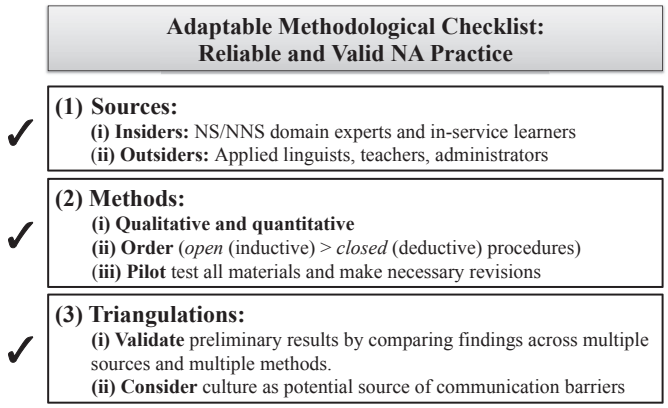

Figure 2. Adaptable methodological checklist for reliable and valid NA practice.

obviously when they and/or the institution they represent have requested the NA. What is certain, however, is that just as the thoroughness and accuracy of a medical diagnosis is likely to make subsequent treatment more effective, so a rigorously conducted NA is likely to provide the solid foundation needed for effective language teaching course design and delivery. It is effort well spent.

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