

Trends and patterns of needs assessments in technical and vocational education: A thematic review

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ABSTRACT

It is theoretically acknowledged that needs assessments generally present holistic views in new, quality improvement or extension of projects. Although previous studies demonstrated the significant contributions of approaches and methods, reviews of the literature on needs assessments describing formal and non-formal technical and vocational higher education were excluded. Therefore, a thematic review of patterns and trends concerning on the needs of needs assessments in technical and vocational higher education between 2016 and 2020 was reported. Guided by the systematic review process and thematic analysis by using ATLAS.ti of Scopus, ScienceDirect and EBSCOhost identified 21 related articles. Further review of these articles produced conceptual framework with two main themes: i) "What is?" and "what should be?" to the project; and ii) Needs of needs assessment including input of needs assessment (experts, resources, time, innovative approaches, knowledge and authentic data) and method of needs assessment as preliminary studies tools, needs identification tools, evaluation tools and decision-making tools. Conceptual framework that synthesizes and uses the findings in organizing and categorizing the needs of needs assessment. Significant contributions for practical, multidisciplinary approaches in technical vocational education were presented as implications for prospective research.

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1. INTRODUCTION

While problems are inevitable, organizations generally have the upper hand in addressing the problems to prevent severe economic, social, and moral consequences. Although some of the solutions are dependent upon organization-specific goals, both tangible and non-tangible solutions are involved. Solutions are typically understood in the context of needs, problems, and job scope analyses. Today it has become a concern of every proactive managers in using needs assessments for developing and implementing varied practical solutions for individuals, work groups and organizations [1]–[3]. Needs assessments, which are generally incorporated into duties of planning, are usually utilized in strategic planning and decision-making. Nowadays, due to the proliferation of cross discipline or interdiscipline, a variety of performance improvement needs using needs assessments are required [4]–[8].

Needs assessments vary in motivation, characteristics, and functions. Firstly, needs assessments are significantly involved in planning. Studies found that proper planning is focused on sustainability and long term profitability rather than just solving current problems [9], [10]. Needs assessments determined how

success and goals were met as the focus of the problem solving is on achieving the goal in toto [4], [9], [11]–[13]. In other words, projects began with needs assessments that provided justifiable performance data and gaps between current and prospective functions of needs assessments. In return, projects emphasizing needs assessments could present insights into the real-world and concrete motivation behind predicting the consequences of projects [12]. Also, needs assessments are generally distinct from needs analyses. Studies established that needs analyses identified solutions through available resources and processes, while needs assessments systematically identified problems required in meeting organizations' goals [12], [14]. For instance, studies revealed that with a needs assessment, an 80% success rate was recorded. However, only a 15% success rate was recorded with needs analysis and 5% when no analysis or assessment was carried out [11]. The stark differences between needs assessments and needs analysis affected the planning and goals of organizations.

In addition, needs assessments does functioned differently in different contexts. Several early studies had indicated the centrality of needs assessments had revealed that needs assessments were used for training in organizations [15]–[21] as opposed in using needs assessments to privilege community and social development planning [22]–[27]. Studies had also associated needs assessments with solving performance-related issues and improvements in managing programs and activities conducted [5]. In addition, needs assessments are also a requirement for dealing with multiple disciplines such as finance management, education, psychology, engineering, agriculture, civil service, information and communications technology, and public and private healthcare services. Nonetheless, there is a dearth of studies that deals with the needs assessment in higher education projects that could be attributed to four factors, namely, the lack of resources, time, expertise, and knowledge [6]. Thus, the models of needs assessments function differently to varying needs, purposes, goals, and organization-dependent contexts [4], [13], [28], [29].

A dramatic surge in needs assessments revealed the centrality of instructional designs and curriculum development [13], [30]–[33]. While studies revealed a relative discomfort with uncertainty data and existing needs assessment articles across disciplines, needs assessment models were found to guide research projects [8]. Needs assessments across studies in education generally emphasized upgrading capital-intensive in providing an equal return to individuals, organizations, societies, and countries [2], [34], [35]. Nevertheless, the broad and different uses of the term 'needs' often generate debates that can conceal the real-world applications of needs assessments. Questions arise due to the direction of needs assessment, in particular on how needs assessments are conceptualized, materialized, and communicated [8], [13]. In the education sector, widespread adoption of needs assessments had privileged the wider field of education because education encompasses a capital-intensive sector with the aspiration of providing equal returns, individually or collaboratively.

While increasing attention is paid to needs assessments surrounding education, needs assessments accompanying stakeholders' knowledge that are carried out in sustaining and retaining long-term profits have yet to be carried out. Besides, studies that revealed properly planned needs assessments that ultimately comply with the needs and personalize needs assessments are rare. Furthermore, studies that also examine required results and priority needs by corresponding stakeholders across technical and vocational higher education are still unavailable, despite heavy emphases that were placed on models drawn from instructional design and curriculum development [13].

Hence, a thematic review of patterns and trends concerning needs assessments in technical and vocational higher education from 2016 to 2020 was therefore reported. In this context, the selection criteria ranges from 2016 to 2020 because of the strategy for Technical and Vocational Education and Training (TVET) 2016 to 2021 addressed the multiple demands of an economic, social and environmental nature of the world [36]. Varied and useful formal and non-formal programs executed by technical and vocational higher education have helped to develop the skills that the students need for employment, decent work and entrepreneurship, promoting equitable, inclusive and sustainable economic growth, and supporting transitions to green economies and environmental sustainability. By virtue of the needs assessment, a properly planned strategy of the formal and non-formal programs would ultimately conform and cater to the actual need by the corresponding stakeholders. A review emphasizing patterns and trends concerning needs assessments in technical and vocational higher education was carried out from 2016 to 2020. Following this, the study was carried out in addressing these gaps by identifying needs (process and input) of needs assessments, establishing a conceptual framework illustrated based on the synthesis gained from the findings.

2. RESEARCH METHOD

Firstly, a brief contextualization concerning thematic review was presented. Secondly, research nuts and bolts capturing the specific approach to thematic review were laid out. Finally, the section ended with a summary of the whole approach to the thematic review. Thematic reviews continued to be recognized as one of the popular methods in research for more than a decade. Thematic reviews are typically defined as the processes of identifying patterns and constructing themes to illustrate a thorough understanding of the subject

[37]. Thematic reviews generally identify gaps and directions for prospective research. A thematic analysis procedure in analyzing publications related to formal and non-formal technical and vocational education concerning needs assessments had adopted the framework laid out by previous researcher [38]. Specifically, by using ATLAS.ti, analyses on existing literature on needs assessment were carried out.

A systematic review was used to locate existing studies. Scopus, ScienceDirect, and EBSCOhost were used as databases in locating the publications because the databases housed the largest abstract and citation databases of thousands of peer-reviewed journals from global publishers. Scopus, ScienceDirect, and EBSCOhost also accommodated various subject publications including social sciences, environmental sciences, agriculture, and biological sciences.

Once the studies emphasizing needs assessments across formal and non-formal technical and vocational education were located, patterns and constructs category of needs assessments in education were generated. Four key stages were involved at this stage. The first phase identified the keywords used in the search process based on the research questions. Table 1 illustrates the keywords used for this study in the search string for the database search. Eligibility and exclusion criteria were determined in the second phase. As seen in Table 1, 126 articles appeared from Scopus (31 articles), ScienceDirect (67 articles), and EBSCOhost (28 articles) databases. First, only articles published between 2016 and 2020 were selected, as illustrated in Table 2. Second, the search functions had excluded non-English publications to avoid confusion and difficulty in translating.

Table 1. Search strings from Scopus, ScienceDirect, and EBSCOhost

Database	Keyword	Numbers of article
Scopus	TITLE-ABS-KEY((need* assessment*) AND (higher education* OR higher institution*) AND (technical OR vocational))	31 articles
ScienceDirect	"needs assessment" OR "need assessments" AND (higher education) AND (technical OR vocational)	67 articles
EBSCOhost	Title: "needs assessment" OR "need assessments" Abstract: "needs assessment" OR "need assessments" AND (higher education) AND (technical OR vocational)	28 articles

Table 2. The inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Publication timeline	2016 and above	2015 and below
Language	English	Non-English

Once the search began using the eligibility and exclusion criteria, 73 articles were removed due to outdated results, incomplete articles, inaccessible full articles, and incomplete digital references. The eligibility and exclusion criteria employed had yielded two insights: first, a broad understanding of articles complying with the subject; and second, an expressive understanding that removed less suitable articles. Thus, the exclusion of articles and in-depth analysis were designed as iterative processes.

In the third phase, 53 journal articles were reviewed and analyzed. Only articles that responded to the formulated questions were selected. Three specific steps guided the phase of reviewing and analyzing the articles. Firstly, data that were extracted were scrutinized through reading the abstracts. Particularly, only abstracts that were associated with formal and non-formal higher education, including technical and vocational knowledge, skills, and attitudes, were selected. Secondly, the full articles were read to identify appropriate themes and sub-themes. Finally, the exclusion process had generated 21 academic papers, after the removal of five duplicated articles. In order for the articles to be included in the review, both authors must mutually agree. Any disagreement was discussed before deciding on the inclusion or exclusion of the articles for the review. The articles were uploaded in ATLAS.ti 8 as primary documents for subsequent trend, pattern, and chronological analyses. Figure 1 presented a summary of the third phase.

Finally, the data were abstracted and analyzed. The finalized 21 articles were transferred to ATLAS.ti 8 and stored as primary documents. From the metadata established in Mendeley, six categories were automatically created, namely: author, issue number, periodical, publisher, volume, and year of publication. Thus, the simultaneous coding entered into ATLAS.ti had allowed for systematic storing, data accessibility, and immediate retrieval. Figure 2 captures an extract of Mendeley metadata. Efforts were concentrated on specific studies that responded to the formulated questions. The data were extracted by reading through the abstracts first, then the full articles (in-depth) in identifying the appropriate themes and sub-themes.

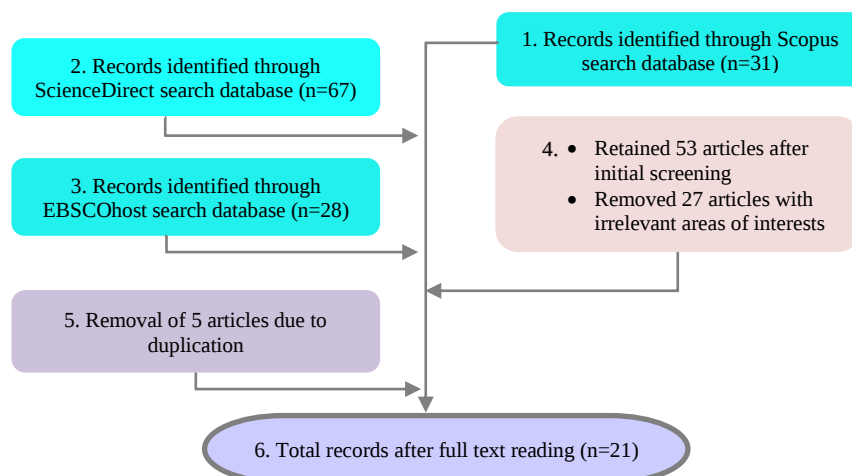


Figure 1. The systematic review process in Mendeley

ID	Name
D 1	Bayer (2020) - Needs Assessment Tool Kit
D 2	Durán (2019) - Mathematics for biological sciences undergraduates: a needs assessment
D 3	Conner (2018) - Needs assessment for informing extension professional development
D 4	Whitaker (2018) - Jobs to Be Done: An Innovative Needs Assessment Methodology
D 5	Comito (2018) - Rapid needs assessment and response technique
D 6	Stefaniak (2018) - The influence of perceived constraints during needs assessment
D 7	Gilmore (2019) - Needs assessment: Watershed science for water resources management
D 8	Goodman (2020) - Employable: Transition Program to Improve Employment
D 9	Stefaniak (2020) - Keeping the Learner at the Focal Point: The Use of Needs Assessment
D 10	Koochi (2016) - Training Needs Assessment of Technical Skills in Managers of
D 11	García (2017) - Integrating Community Services and Research: A Livelihood Needs Assessment
D 12	Gusto (2020) - Identifying forest health gaps: A needs assessment of tree and
D 13	Narine (2020) - Application of a Three-Phase Needs Assessment Framework
D 14	Maudarbox (2016) - Interreligious education: Conceptualising a needs assessment
D 15	Sermirikarnjana (2017) - An Integrated Science Process Skills Needs Assessment
D 16	Bezyak (2016) - Promoting Physical and Mental Health Among College Students
D 17	Yopp (2017) - A Multidimensional Needs Assessment of Social Emotional Learning

Figure 2. Auto code established from Mendeley metadata

3. RESULTS AND DISCUSSION

3.1 Background of the selected articles

The review managed to obtain 21 selected articles. There were 15 journals involved: Journal of Extension (seven articles), Asia-Pacific Forum on Science Learning and Teaching (one article), International Education Studies (one article), International Journal of Designs for Learning (one article), International Journal of Mathematical Education in Science and Technology (one article), International Review of Education (one article), Journal of Agricultural Education (one article), Journal of Computing in Higher Education (one article), Journal of Education and Practice (one article), Journal of Occupational Therapy, Schools, and Early Intervention (one article), Learning Assistance Review (one article), Procedia - Social and Behavioural Sciences (one article), Public Health (one article), Rehabilitation Research, Policy, and Education (one article), and Value in Health Regional Issues (one article).

Several findings involving years of publication, countries of publication, and model approached, including the summary of needs assessments were discussed in terms of comprehensiveness of content and justification of methodology. A word cloud was used to provide a general representation of the finding. The word cloud, typically defined as the size of words, depicted the frequency or centrality of the content. However, the word cloud generated by ATLAS.ti 8 illustrated that the highest hit word usage was 'needs' (801 times). Others included 'students' (540 times), 'education' (530 times), 'assessment' (491 times), 'learning' (425 times), and 'extension' (377 times). When these words were categorized, the theme of the most prominent word cloud emphasized 'purpose' and 'stakeholders' related to technical and vocational higher education. Figure 3 shows the word cloud data visualization based on the 21 articles.



Figure 3. Word cloud generated from 21 articles

Needs assessment articles continued to be published in various fields such as education, healthcare, industry, government, and for non-profit purposes. Although it is well regarded that developing and executing the needs assessment are often the most important and time-consuming steps in the process of setting up the related goals for a specific educational program, however the same cannot be said in terms of technical and vocational higher education. Conducting needs assessments served as a valuable way for technical and vocational higher education in ensuring that they are designing formal and non-formal programs that meet the identified needs. Based on summary of the whole approach to the thematic review as presented in Table 3, four interpretations (year of publication, countries of publication, method approached and model approached) concerning the thematic review could be made. Trends and patterns showed that the writing spread was uneven according to country, there were no increase in the number of publications according to the year of publication, and many of the articles do not clearly report any needs assessment models guiding their projects or diverging tactics. Nonetheless, there were a variety of methods being used to identify prominent needs where qualitative and mixed methods had become the trend.

Table 3. The findings

Author	Year	Country	Method	Model/framework	Fields				Need assessment as				
					CD	CP	SD	TN	ID	PS	NT	ET	DT
[39]	2016	USA	Quantitative	n/a			/			/	/		
[15]	2016	Asia	Qualitative	n/a				/			/		
[30]	2016	Africa	Qualitative	n/a	/						/		
[24]	2017	Asia	Qualitative	n/a		/					/		
[31]	2017	Asia	Quantitative	n/a	/						/	/	
[40]	2017	USA	Mixed method	n/a					/		/		/
[41]	2017	USA	Qualitative	n/a					/		/		/
[16]	2017	USA	Quantitative	Borich needs assessment				/			/		
[17]	2018	USA	Qualitative	The rapid needs assessment & response technique				/			/		
[18]	2018	USA	Mixed method	n/a				/			/		
[8]	2018	USA	Qualitative	n/a					/	/	/		/
[27]	2018	USA	Qualitative	Job to be done framework		/					/		
[42]	2019	USA	Qualitative	n/a					/		/		
[32]	2019	USA	Mixed method	n/a	/						/	/	
[19]	2019	USA	Mixed method	n/a				/			/	/	
[43]	2019	USA	Quantitative	n/a					/		/		
[25]	2020	USA	Mixed method	n/a		/					/		
[44]	2020	USA	Mixed method	n/a			/			/			
[33]	2020	USA	Mixed method	n/a	/						/		
[26]	2020	USA	Quantitative	Three-phase needs assessment framework		/					/		
[45]	2020	USA	Mixed method	n/a			/				/		

Note. Fields: Curriculum developments (CD); Community development programs (CP); Student development programs (SD); Training needs (TN); Institutional development (ID). Need assessment as: Preliminaries study tools (PS); Need identification tools (NT); Evaluation tools (ET); Decision making tools (DT)

Based on the year of publication, it could be seen that firstly, the average total of annual publications for needs assessments across technical and vocational higher education was four, starting in 2016. Even though, many formal and non-formal activities and programs were planned under technical and vocational higher education, but the total annual publication for needs assessment is low. The limitation in

terms of adoption rates of needs assessment in technical and vocational higher learning education would suggest prospective initiatives to multiply needs assessments. Secondly, across the literature, far fewer studies concerning needs assessment in technical and vocational higher education could be attributed to four factors, namely, the lack of resources, time, expertise, and knowledge [6].

According to the country and method approached, three interpretations could be made. Firstly, journal articles published in the United States of America (USA) soared as the country that had the highest number of publications between 2016 and 2020. Secondly, it could be deduced that scholars affiliated with institutions in the USA had relatively higher awareness on preparing and simplifying needs assessments than Asian and African scholars. This could be attributed to the simplified needs assessment innovation that was introduced to the scholars affiliated with the USA. Thirdly, studies on needs assessments employing mixed methods were on the rise. As argued by Whitaker [27], although the quantitative method could identify prominent needs, quantitative methods were not able to suggest the broad subsequent application of needs assessments.

Needs assessments in education that would best depict the needs of individuals, institutions, and socio-economic development of the nation were emphasized. Although types of needs assessments were not explicit, several needs assessment models were noteworthy of attention. Notable mentions of needs assessments were rapid needs assessment and response technique [17], Borich needs assessment model [16], a framework of job compliance [27], three-phase needs assessment framework [26], instructional designer competencies and performance standards for planning and analysis.

3.2. Conceptual framework

A conceptual framework as shown in Figure 4 is derived from the insights gained based on the review. The conceptual framework revolves from the concept of gaps and needs being adapted from previous studies [11], [22]. Needs is the gap between “what is” and “what should be” or the gap between current and desired result [12], [22], [46]. The concept of needs are categorized into two types: needs in ‘processes’ that refers to methods and needs in ‘input’ that refers to resources [1], [11]. The conceptual framework from this concept would provide the realistic and rational reason for both “what to change” as well as “what to continue” [47].

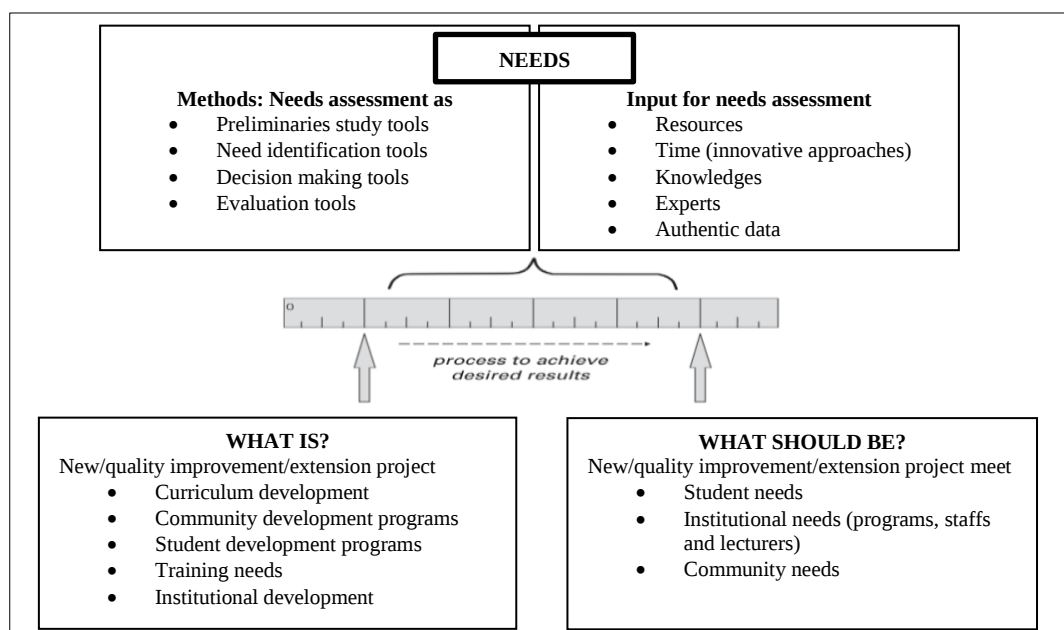


Figure 4. Conceptual framework [11], [22]

3.2.1. “What is?” and “what should be?” to the project

It is theoretically acknowledged that needs assessments could initiate and extend program development, quality improvement, and new development projects [26], [39], [44]. Conducting the needs assessments could generate additional knowledge concerning quality improvement, new and extended education development projects. Needs assessments are carried out to ensure that programs were designed to meet student, institutional, community, and stakeholder needs.

A majority of needs assessments emphasized instructional design and curriculum development project [13]. Furthermore, needs assessment models contextualized development programs and training for students, institutions, and communities. Needs assessments on curriculum development and training were not only popular but also in demand in the context of institutions and community development. Firstly, needs assessments were frequently employed for non-formal community program development, advancement, and improvement. Secondly, needs assessments were in demand for formal academic and research programs across higher education

3.2.2. Needs of the project

a. Methods: Needs assessment

Needs assessment, which are often included into various planning activities, are commonly utilized in strategic planning and decision-making. Thematic analyses across 21 papers yielded four themes on method of needs assessment. It is namely: preliminaries studies tools, need identification tools, evaluation tools and decision-making tool. Figures 5-8 present a network view coded from ATLAS.ti 8, four themes on methods of needs assessments in technical and vocational higher education.

Preliminary studies tools

Conducting a needs assessment had been recognized by many researchers as a front-end step of any intervention design as shown in Figure 5. Thematic analyses suggested that practitioners should be involved in incorporating sufficient data from clients and project stakeholders for identifying internal and external project needs [14]. A surge in demands across needs assessments also meant that data gathering and analysis processes carried out during preliminary studies could address clients' needs [8]. Thus, thematic analyses revealed that needs assessments used during preliminary studies could bolstered an understanding of projects and determined the models of prospective projects. Prospective exploration with the sole focus on needs assessment strategies and needs assessment being made as preliminary studies would ultimately benefit practitioners.

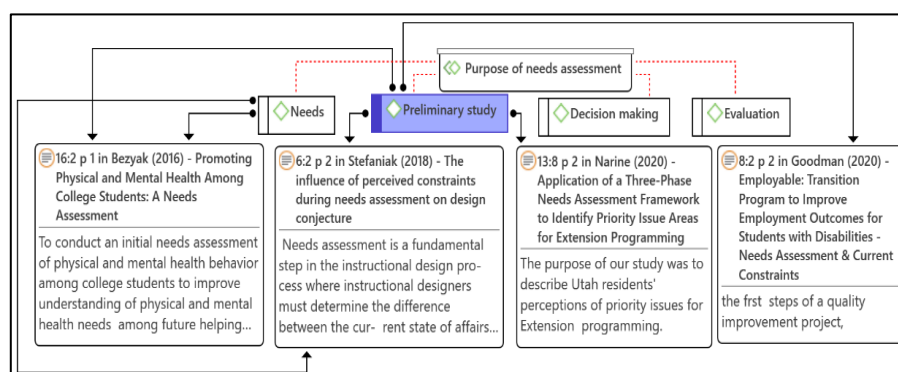


Figure 5. A network view on the functions of needs assessment in preliminary studies

Needs identification tools

Needs, typically defined as disparities between current job results and the intended job results, are clear indicators in identifying disparities, deficiencies, and opportunities [11], [22]. Interestingly, the thematic analysis revealed that individuals' deficiency in terms of basic knowledge, attitude, and skills hampered organizations' efficiency and performance. In addition, the thematic analysis revealed that needs analyses managed to identify ways to encourage individuals to embody weaknesses and display true potentials.

Apart from that, the thematic analysis showed that poor job performance had prevented potential individuals from discharging their responsibilities for a different or bigger capacity. Hence, Figure 6 shows that needs assessments managed to identify the needs that functioned to bridge the gaps between current and desired results [18], [27], [31], [41]–[43], prioritize needs based on its importance and feasibility [18], [27], [30], [31], identify the most important needs [15], [16], [18], [19], [24], [25], [27], [32], [33], [39], [40], [45], [48] and design solutions to eliminate irrelevant needs [8], [24], [33].

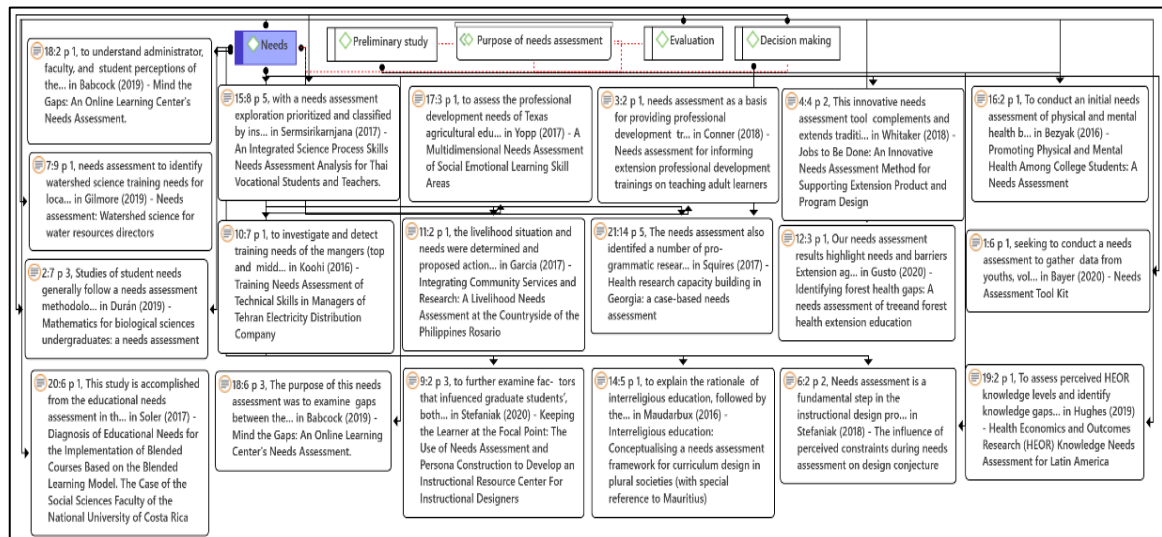


Figure 6. A network view on general functions of needs assessments in needs identification

Evaluation tools

Thematic analysis revealed that needs assessment could be used for evaluation as part of the decision-making processes in solving organizational disparities and problems [22], [32]. Figure 7 captures a network view on functions of needs assessments in carrying out evaluations. The outcome of needs assessments could also be used to compare two groups of stakeholders who had the same goal consideration [19]. By focusing on needs assessments, appropriate interventions could be put into place.

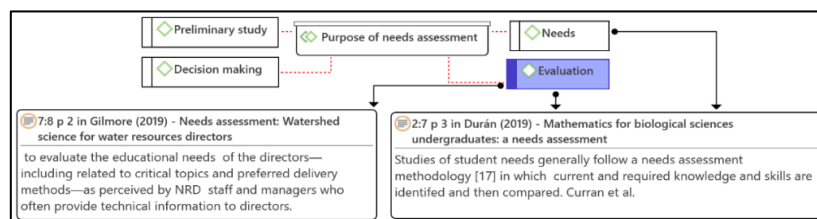


Figure 7. A network view on functions of needs assessments in carrying out evaluations

Making tools

Decision-making is typically defined as plans that ensure success in project management. The management of organizations would generally set out plans that comply with the needs of all individuals. Decision-making in organizations is not based on a single view and perception. Thus, the thematic review revealed that comprehensive and accurate decision-making and alternatives guided the growth of studies in decision-making [8], [40], [41] as shown in Figure 8.

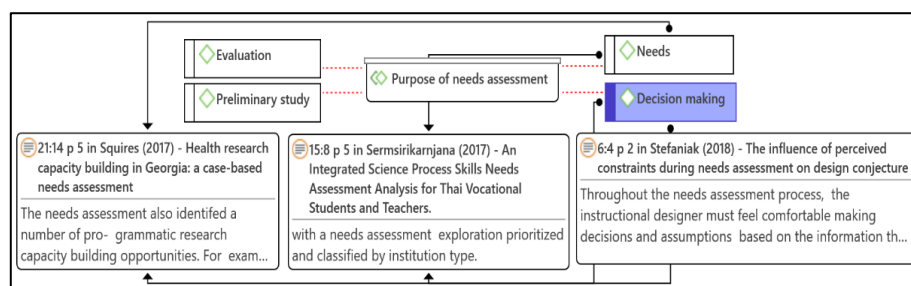


Figure 8. A network view on functions of needs assessments in decision-making

b. Input for needs assessments

Despite the availability of hundreds of journal articles concerning needs assessments, how needs assessments should be implemented still remained unknown. While it is generally expected that stakeholders were aware of the importance of needs assessment, far fewer studies examined the implementation of needs assessment in technical and vocational higher education due to the lack of resources including budgets, time, expertise, and knowledge [6], [8]. The most frequently described challenge was time, budgets constraints and resources [4], [49]. Therefore, authentic data measured through reliable instruments are key predictors in ensuring accuracy in the presentation of the results.

Secondly, the lack of innovative approaches that simplified the processes of needs assessments could explain why the numbers of needs assessment adoption among stakeholders were limited [8]. Thirdly, prospective research emphasizing the executive roles of managers and administrators might better consider higher education and the wider field of education. Finally, needs assessment strategies and needs assessments that function to provide information for preliminary studies might better be considered. Needs assessments that bear a resemblance to Rapid 'Needs Assessment Model' could encourage widespread adoption of needs assessments [6], [17]. Therefore, needs assessments in the future that encompass a holistic view of education could improve the development of socio-economic conditions of people.

4. CONCLUSION

The review on emphasizing technical and vocational higher education have generated refreshing insights about the trends, patterns, and needs of needs assessment in a variety of formal and non-formal circumstances. Several points could be raised. Needs assessment would not just focus on training needs, instructional and curriculum development. Its application could be widely used in students' development, institutional development and community development programs. Apart from that, its use is not limited to needs identification only, as its use is now covering preliminaries study, evaluation and decision-making. A needs assessment is essential for each performance improvements circumstances in meeting educational goals. One way of ensuring the continuing value of designing programs is through well-designed needs assessments. In fact, needs assessment is diversified and transformed by marching time, it is recommended to always have enough resources, time to diversify innovative approaches, knowledges, experts and access to authentic data. From the review, both the drivers and enablers had used needs assessments for planning, designing, developing, implementing and evaluating varied practical solution that could generate short and long term adaptation strategies for the formal and non-formal circumstances. The result offers some basics on integrating local knowledge with scientific findings for the needs of needs assessments, apart from providing suggestions on the role of the needs assessments in new, extension and quality improvement projects.

In response towards this, there are several adaption strategies that have been proposed to be carried out in response to compulsion and the importance of needs assessments. With the changes in the education sector, it would be most prudent to continuously embark on conducting needs assessment projects in different periods and applying it as a prerequisite for planning and designing educational formal and non-formal programs. Needs assessment has to be periodically done, not temporarily based on modern and scientific methods and principles. The top management is expected to provide the required facilities and research contexts, especially in communications and facilities relevant to an ever-changing world of modern information where the practitioners would be using it. Many of the valuable improvements in technology is also creating new updates to online assessment data collection methods. Other than that, authorities have to motivate employees, managers and experts to increasingly learn in strategic management and job areas.

The significant contributions of needs assessments in new, quality improvement or extension of projects is theoretically acknowledged. Significant contributions for practical, multidisciplinary approaches in technical vocational education were presented as implications for prospective research. The review suggests several recommendations for future studies to address suitable model of needs assessment for a variety of educational organizations, format and strategies employed and best practices with detailed explanation of needs assessments in various educational fields.

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