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Local Content Expert-assigned Taxonomy with Library of Congress Subject Headings (LCSH): A Comparative Analysis

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ABSTRACT

Taxonomy is a classification system that helps researchers conceptualize phenomena based on their dimensions and characteristics. It is an integral process involving a high complexity in understanding a subject classification. This paper aims to represent an update for the taxonomy development of Sports Science and recreational; it contributes to the prescriptive knowledge of taxonomy design and seeks to augment both rigorous taxonomies building and evaluation, including a comprehensive analysis of the expert-assigned keywords with a comparison to Library of Congress Subject Headings. This study employs comparative subject analysis as the methodology for comparing expert-assigned keywords with LCSH. The analysis will identify the similarities and differences in the classification of the taxonomy used in the UiTM Local Content Hub. The subjects used in Sports Science & Recreational Digital Collection in PTAR Local Content Hub are very minimal compared to the structured classification of subjects in the classification web.

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INTRODUCTION

The emergence of the new subject matter has contributed to the rapid development of classification in knowledge. Sports science and Recreational are innovative subjects in recent world knowledge development. The rapid development of knowledge discoveries has drastically determined new taxonomy. According to Abukhader (2018), taxonomy development is the basis of knowledge classification. The importance of taxonomy development in research has been long acknowledged in identifying subject classification. The extended description of the importance of taxonomy Miller & Roth (1994) described taxonomy as a helpful discussion and pedagogy. Problems in subject classification in specific subjects depend on the content's natural and local behavior (Ress, 2020). Research reporting difficulties in taxonomy development, including in information systems (Nickerson et al. (2012), biology, and knowledge management (Abukhader, (2018). Concerning sports science (Pauw, Roelands et al (2013) highlight that the utmost significant problem is standardizing the data according to the classified subject group. Sports science and recreational subject classification in UiTM Local Content Hub are very much localized in the Malaysian context. Therefore, the domain classification is unstructured and lacks uniformity compared to the established standard subject headings used in Library of Congress Subject Headings. Thus, this study will comprehensively analyze sports science and recreational taxonomy, including the knowledge domain and classification in facilitating librarians and researchers in research and subject classification works. This paper aims to report on the taxonomy development process of sports science and recreation in UiTM and to report the analysis of expert-assigned keywords with comparison to the Library of Congress Subject Headings. The problem of stress in the workplace is a chronic issue that is often discussed in every organization. This problem exists in almost all organizations including large organizations such as in the United States, the United Kingdom, and Japan. The problem of stress needs to be overcome as best as possible because it can affect the performance and productivity of an organization. A report issued by the World Health Organization (WHO) predicts that workplace stress could be one of the causes of human health problems by 2021. In Malaysia, Union Congress Employees in Public Service (CUEPACS) stated that there were more than 21,000 workers who retired early due to workplace stress in 2018. The main thing to emphasize is whether the employee can overcome the problem before it gets worse. Unfortunately, Malaysia has little producing empirical national data on the prevalence of OS (Ismail et al., 2023). The study conducted by Mukosolu et al. (2015) regarding the prevalence of Job Stress and factors has proof that employees in Universiti Putra Malaysia experienced stress at a rate of 23.1%, which is greater than the average rate for other sectors (19.8%). The determination of how depressed employees are, and their prevalence will provide valuable data and information to those who are concerned with this problem. This finding can also be used for future intervention programs that will benefit employees in Malaysia.

LITERATURE REVIEW

Libraries face a similar problem when classifying their documents and resources (Keck et al., 2023). Most libraries need help distinguishing the level of taxonomy and classification. Ensuring the success of taxonomy development requires both taxonomy expertise and in-depth knowledge of the knowledge/ content. Therefore, it is crucial to include subject matter specialists and librarians in the team to help identify the taxonomy for the content. This literature review will provide an overview of taxonomy development through the basic lenses of definitions and differences in the three related elements: Ontology, Taxonomy, and Classification.

Defining ontology, taxonomy, and classification

A general understanding of ontology, taxonomy, and classification liaises on the complexity level. Merriam-Webster Dictionaries (2019) classified ontology as the most basic and unstructured concept,

followed by classification as a systematic arrangement. Taxonomy is derived from the Greek word *taxis*, which means organization or order, and *nomos*, which means law or science. The term taxonomy is used in two aspects: first, the specific meaning, which is to refer to a hierarchical classification or categorization system, and second, the broader sense, meaning to refer to any method of arranging knowledge concepts (Hedden, 2022). In library and information science, classification is described as hierarchically organizing knowledge by classifying concepts and topics concerning one another (Chatterjee, 2021). Classifying is also an investigative approach that involves sorting objects or events into groups or categories. The systematic arrangement of things based on certain similarities or differences allows us to understand relationships and connections between things better.

Differentiating classification and taxonomy

Naveen (2018) explains classification as the arrangement of organisms according to a set of principles, which can be numerous, whereas taxonomy is one defined and the most respected classification system. In understanding the classification system and taxonomy development, librarians must be able to differentiate the nature of each process. Table 2 highlights the differences between both processes.

Table 1: Difference between taxonomy and classification system

Classification System	Taxonomy
1. Based on codes and notation.	1. Did not apply any codes.
2 Systematic arrangements in groups or categories according to established criteria.	2. A form of knowledge organization system in Which concepts are linked to one another in a hierarchical order
3. Limitation in the expansion of numbers – only within the structure.	3. Can be expanded and adapted without any limitations or restrictions.
4. The process of distributing things into classes or categories of the same type.	4. Deals mainly with the description, identification nomenclature, and classification of organisms.
5. It is created to be browsed from top to bottom hierarchically.	5. It is designed to be browsed, searched, or may not be wholly presented to users.

Source: Hedden, (2022)

Taxonomy Development

Developing a taxonomy involves determining the characteristics of the objects of interest. The choice of characteristics in a taxonomy is a central problem in taxonomy development. The characteristics could be based on a theory, but any 'theory' is often implicit (Aldenderfer & Blashfield, 1984). It is envisaged that taxonomies will change over time to incorporate new information. Taxonomy development helps to organize content and make connections between people and the information they need. Usman, Britto, Borstler, and Hendros (2017) emphasize that developing taxonomies in software engineering can be expanded and must be done more systematically to structure and better understand its area. As for the subject of health and well-being, taxonomy development is continuing to evolve and update. Lee (2022) describes adopting a consistent taxonomy to develop communication between and within the related sector. The study summarized the processes and outcomes of a collaborative, intersectoral, and interdisciplinary project to develop a shared terminology, taxonomy, and ontology for this area.

Expert-assigned keywords or Author-assigned keywords

According to Theda, Sevim & Margaret (2012) and Gil-Leiya & Alonso-Arroya (2007), the relationship between taxonomy development and expert-assigned keywords lies in their shared goal of categorizing and organizing information to improve its accessibility and retrievability. Both taxonomy

development and author-assigned keywords are methods used to structure and label information, but they serve different purposes and are often used in distinct contexts. These keywords are chosen based on the author's judgment and understanding of the document's content, and they can vary in specificity and relevance (Sheng, Gero & Ho, 2022). The selection of appropriate author-assigned keywords is essential for effective information organization and retrieval, as they help users locate and access relevant documents amidst a vast sea of information. The relationship is described in Table 2.

Table 2: Relationship between experts assigned keyword and taxonomy.

Contexts	Expert-Assigned keyword	Taxonomy
Purpose and Scope	Specific words or phrases chosen by the creator of a document (e.g., a researcher, author, or content creator) to describe the content of that document. Their purpose is to improve the discoverability of that specific work within a broader collection or database.	Typically, comprehensive, hierarchical systems are used to classify and categorize a wide range of items or concepts within a specific domain. Their purpose is to create a structured framework for organizing knowledge, and they often involve a predefined set of categories and subcategories.
Hierarchy vs. Flat Structure	Typically, a flat list of terms or phrases without inherent hierarchical relationships. Each keyword is treated as having equal importance in describing the content.	Hierarchical in nature, with categories organized in a structured manner, often with broader categories at the top and increasingly specific subcategories beneath them. This hierarchy allows for a systematic classification of information.
Scope of Application	Specific to individual documents and are applied at the discretion of the document's creator. They reflect the author's understanding of the document's content and context.	Generally designed for broader, institutional, or field-wide use. They are applied consistently across a range of materials or documents within a particular domain.
Controlled Vocabulary vs. Free Text	It is more flexible and may include free-text terms that reflect the author's unique perspective, terminology, or focus.	Involve the creation of controlled vocabularies, where terms are pre-determined and standardized to ensure consistency in categorization.

Taxonomy Analysis

According to Doty et al. (1993), the ideal types and organizational configurations are the overall effectiveness of a resulting taxonomy to classify objects in a domain. Taxonomy analysis involves the systematic classification and categorization of elements to make structured and meaningful comparisons. This method helps to identify similarities, differences, and relationships among entities within a specific domain. (Butt, 2007; Saqib, 2019, 2021), More research needs to analyze the existing classifications and develop new classifications. It facilitates a more rigorous and organized comparison, leading to nuanced insights and informed decision-making. Expert-assigned taxonomies play a crucial role in knowledge organization and management. By systematically analyzing and refining these, one can enhance their effectiveness, ensuring they accurately reflect the complexities and nuances of the subject matter. While keywords and taxonomies serve different purposes, they complement knowledge organization. Overall, a classification system’s usefulness is determined by its capacity to generate knowledge or to facilitate predict

task advancement (Miller, 1996; Luz et al., 2008). Expert-assigned keywords provide specific content associations, while taxonomies offer a broader, structured framework for organizing concepts within a domain. Both contribute to effective information retrieval and management. Taxonomy analysis uses various methods, such as content analysis, coding, or data mining. The analysis can be qualitative or quantitative, depending on the nature of the data and the research questions.

METHODOLOGY

This analysis applied a subject analysis method as the research approach. The analysis **INVOLVED** a comparison of the Sports Science & Recreational Digital Collection taxonomy from UiTM Local Content Hub with Library of Congress Subject Headings online (Classification Web). The Sports science and recreational digital collection taxonomy is based on the expert's knowledge, which is known as an Expert-assigned keyword. Two types of analysis are involved in this **COMPARISON**: **(**i) analysis of subject division terms and **(**ii) analysis of taxonomy terms. The subject **DIVISION** terms analysis involved three steps, as described in Table 3.

Table 3: Subject division analysis steps

Step	Procedure	Output
1	Identification of taxonomy divisions in both Sports Science & Recreational Digital Collection in UiTM Local Content Hub and Sport and Recreation in Library of Congress Subject Headings.	Comparison of the number of divisions
2	Identification of the number of subjects in both Sports Science & Recreational Digital Collection in UiTM Local Content Hub and Sport and Recreation in Library of Congress Subject Headings.	Comparison of the number of subjects
3	Summarize the categories of terms in the Sports Science & Recreational Digital Collection in UiTM Local Content Hub and Sport and Recreation in Library of Congress Subject Headings.	Percentage of the terms categories

The analysis of taxonomy terms involved comparing taxonomy terms assigned by the local content expert with the taxonomy in LCSH, 3 categories of terms have been identified as exact terms, similar terms, and not-used terms. In summary, the analysis involved 8 taxonomies at the level of divisions and 46 taxonomies of the subject's classification level. The analysis of taxonomy terms will identify the similarities and differences in the classification of the taxonomy used in the digital collection hub compared to the Classification Web.

STUDY FINDINGS

The analysis reported the following main discoveries. The first analysis on the comparison of the number of divisions found that there are six (6) divisions in PTAR Local Content Hub compared to only two (2) divisions in LCSH. The comparison of the number of divisions from both collections is identified in Table 4 below.

Table 4: Comparison of the number of divisions

UiTM Local Content Hub	Divisions	Library of Congress Subject Headings	Divisions

Sports Science & Recreational	Health and Fitness Martial Arts Outdoor Recreation Sport Management Sport Science Sport Tourism	Sport and Recreation	Sports Recreation
No of divisions	6		2

The second analysis on the comparison of the number of subjects found 364 subjects in UiTM Local Content Hub compared to only 98 subjects in LCSH. The comparison of the number of subjects from both collections is identified in Table 5 below.

Table 5: Comparison of the number of divisions

UiTM Local Content Hub	Divisions	No of Subjects	Library of Congress Subject Headings	Divisions	No of Subjects
Sports Science & Recreational	Health and Fitness	186	Sport and Recreation.	Sports	81
	Martial Arts	27		Recreation	17
	Outdoor Recreation	38			
	Sport Management	156			
	Sport Science	210			
	Sport Tourism	18			
No of subjects		364			98

The analysis of the number of terms revealed that 164 terms from the Sports Science & Recreational Digital Collection subjects were analyzed, and three different categories were identified which are Exact terms used to refer to the same subject terms used in the LC classification web, Similar terms used refer to partial or similarity in the terms used, and finally Not used terms referring to terms not used in classification web. Table 6 highlights the number of exact terms, similar terms, and not-used terms.

Table 6: Number of exact, similar, and not-used terms.

PTAR TERMS	Expert-Assigned Keywords and Terms used in LCSH	PERCENTAGE (%)
Exact Terms Used	14	**14.6%**
1. Sports Science	2	
2. Sports Management	5	
3. Health & Fitness	3	
4. Outdoor Recreation		
Similar Terms Used	4	**6.7%**
1. Sports Science	1	
2. Sports Management	3	
3. Health & Fitness	1	
4. Sport Tourism	1	
5. Outdoor Recreation	1	
6. Martial Art		
Not Used Terms	31	**78.7%**
1. Sports Science	47	
2. Sports Management	14	
3. Health & Fitness	12	
4. Sport Tourism	21	
5. Outdoor Recreation	4	
6. Martial Art		
TOTAL	**164**	**100%**

Analysis

Based on the findings of the comparative analysis in Table 6, there are a total of 164 terms analyzed, which are divided into three categories of terms referring to Exact Terms, Similar Terms, and Not Used Terms, which are derived from 16 divisions of subjects. The comprehensive analysis of the subject terms is illustrated below in Table 7 for exact terms, similar terms in Table 8, and not-used terms in Table 9.

Table 7: Analysis of exact terms

EXACT TERMS			
Exact Terms Used **Sports Science** 1. Biomechanics 2. Nutrition 3. Rehabilitation 4. Measurement 5. Anxiety 6. Individual Sport 7. Teaching Method 8. Training 9. Competition 10. Anatomy and physiology 11. Self-talk 12. Imagery 13. Learning 14. Sports medicine	**Exact Terms Used** **Sports Management** 1. Entrepreneurship 2. Qualitative analysis	**Exact Terms Used** **Health & Fitness** 1. Eating disorders 2. Chronic diseases 3. Mental health 4. Depression 5. Anxiety	**Exact Terms Used** **Outdoor Recreation** 1. Survival 2. Swimming 3. Leadership

Table 8: Analysis of similar terms

SIMILAR TERMS		
Similar Terms Used **Sports Science** 1. Exercise Physiology 2. Kinesiology 3. Coach-Athlete Relationship 4. Motor learning	**Similar Terms Used** **Sports Management** 1. Experimental research	**Similar Terms Used** **Health & Fitness** 1. Nutrition's 2. Sleep disorder 3. Burnout
Similar Terms Used **Sports Tourism** 1. Eco-Tourism	**Similar Terms Used** **Outdoor Recreation** 1. Kayak	**Similar Terms Used** **Martial Art** 1. Silat

Table 9: Analysis of not used terms

NOT USED TERMS		
Not Used Terms **Sports Science**	**Not Used Terms** **Sports Management**	
1. Sport Biomechanics 2. Injury Screening 3. ACL 4. Motion analysis 5. Kinematic 6. Kinetic 7. Movement analysis 8. Adapted sport 9. Performance testing 10. Skill acquisition 11. Coaching Effectiveness 12. Sport Psychology 13. Performance analyses 14. Mental toughness 15. Strength training 16. Functional training 17. Team sport 18. Fitness 19. Creative and innovative 20. Psychological enhancement 21. Motor control 22. Augmented feedback 23. Practice variability 24. Ecological dynamics 25. Movement coordination 26. Sports Coaching 27. Talents Development 28. Fundamental Motor Skills 29. Performance Profiling 30. Skill Transfer 31. Applied sport psychology	1. Motivation of participation 2. Structural constraints 3. Intrapersonal constraints 4. Interpersonal constraints 5. Cultural constraints 6. Volunteerism 7. Sports cape factors 8. Sponsorship 9. Sport Marketing 10. Sport Communication 11. Leadership in sport 12. Sport History 13. Communication 14. Sports Law 15. Sport Sociology 16. Team Cohesion 17. Online Learning 18. IT in Sports Science 19. ICT in Sports 20. Sports Disable 21. Sports Sponsorship 22. Sports Administration 23. Sport Facilities 24. Olympic 25. Accounting in Sport 26. Event management 27. Sport counselling 28. Sports Media 29. Sports Finance 30. IT in sports management 31. MOOC in sports studies 32. Data management in sports	33. Technology in sports 34. ICT in sports performance 35. Computer devices for sports 36. Software for sports 37. System in sports 38. Sports Education 39. Online learning in sports 40. Online learning in nutrition 41. Managing athlete data 42. Profiling sports education 43. Profiling athlete 44. Sports data analysis 45. Statistics in sports 46. Thematic analysis 47. Survey research

NOT USED TERMS			
Not Used Terms **Health & Fitness**	**Not Used Terms** **Sports Tourism**	**Not Used Terms** **Outdoor Recreation**	**Not Used Terms** **Martial Art**
1. Health Science 2. Community Health 3. Cardiovascular science 4. Exercise Science 5. Body composition 6. Community Nutrition 7. Exercise prescription 8. Adapted physical activity 9. Physical activity 10. Sport Counselling 11. Healthy food 12. Emotional health 13. Behavior psychology 14. Sedentary	1. Motivation of participation 2. Structural constraints 3. Intrapersonal constraints 4. Interpersonal constraints 5. Cultural constraints 6. Halal tourism 7. Islamic tourism 8. Adventure Tourism 9. Nature Tourism 10. Sport Tourism Event 11. Sport Tourism Industry 12. Sports Hospitality	1. Basic Camp Craft 2. Basic first aider for outdoor activity 3. Knotting 4. Map and Compass 5. Orienteering 6. High Rope Course 7. Low Rope Course 8. Outdoor Recreation Pursuit 9. Safety and Risk in Outdoor Recreation 10. Motivation and Involvement in Outdoor Recreation 11. Basic Swimming Rescue 12. Outdoor communication 13. Scuba 14. Leisure and Recreation 15. Park Planning Management 16. Recreation Resource Management 17. Outdoor Recreation Programming 18. Leisure and Disability 19. Inclusive Recreation 20. Therapeutic Recreation 21. Wilderness First Aid	1. Combat Sports 2. Martial Arts Tourism 3. Cultural & Heritage 4. Malay Sports

DISCUSSION

The taxonomy of the Sports Science & Recreational Digital Collection in the PTAR Local Content Hub shows that the expert-identified terms or expert-assigned keywords are collective in research in other fields. The findings revealed a vast difference in the number of divisions. Omair and Alturki (2020) emphasized that the unstructured terms proposed by the professionals in system development are acceptable for their study. An essential phase of taxonomy development highlighted by Poser, Wiethof, and Bitter (2022) is the evaluation of division and subjects, using the illustrative scenario as the evaluation technique enables them to access the coherence of internal structure. Nevertheless, the differences in the number of divisions in the subject are also highlighted by Poser, Wiethof, and Bitter (2022) to vary based on the subject development and new knowledge categorization.

The Exact term used in the study explained that the authors have the same understanding of the subject matter. The identification and selection of terms were influenced by the author/user's prior knowledge of the subject. The exact terms were also reported by Milne (2010) in records management practice and Abukader (2019) in his study on library and information science, which found a significant number of terms that are valid and usable for library and information science even though the percentage is at an average of 17% and reported to be influenced by the author's prior knowledge or subject background. The same understanding can be seen in this study result, which gained 14.6% of exact terms used in UiTM Sports Science & Recreational Digital Collection.

The expert-assigned keywords or terms having similarity with the established classification were also reported by Valderrama-Zurián et al., (2021) in the cannabis research. They reported that most of the terms are similar at 75% due to classification redundancy. Early Wang, Chaudhry & Khoo (2007) reported that the challenge in the taxonomy is having redundancy in the categories, comprehension level, subject coverage, and hierarchical structure of the classification terms. A recent study reported that the approach to undertaking redundancy is to apply procedural realignment of a past study by incorporating taxonomy-building elements for taxonomy creation (Ahmad et al., 2022). However, a contrasting finding was reported in this study, in which only 6.7% are similar terms, indicating that local keywords influence keyword selection (Olson & Boll, 2001).

The Not Used Terms refers to the terms not used in LCSH. It was a prevalent situation in subject analysis. This study found that 78.7 % of terms are not in use in LCSH. Researchers from various fields reported the same situation, and the main reason was a distinction between expert or professional indexer knowledge and subject field knowledge. According to Hjørland, Birger, and Claudio, this was due to the variation of native speakers between American and British English languages alongside the translations of LCSH (e.g., in Turkey and Malaysia), which add the variants and choice of terms.

CONCLUSION AND RECOMMENDATION

In conclusion, this comparative analysis will provide insight into the subject-assigned practice and the discovery of new terms under the Not-used terms, which are significant to the local development content. The subjects used in Sports Science & Recreational Digital Collection in PTAR Local Content Hub are very minimal compared to the structured classification of subjects in the classification web. Therefore, it is important to understand information retrieval from a global perspective. Libraries must first facilitate information retrieval by using and promoting a standard and uniform subject classification while empowering the expert to assign keywords and subjects. Thus, significant exposure to standard subject classification, such as the classification web, is to be offered to UiTM researchers and experts. Besides, the

PTAR Local Content Hub may also venture into expanding the thesauri and taxonomy tree that aligns with the emerging literature in recent knowledge development and creation. A standard format or template is introduced to researchers to propose new terms or subjects. At the same time, a verification element should control the variation of terms and subjects. PTAR Local Content Hub content is an excellent effort in gathering the multi-content of UiTM intellectual properties while promoting library functions in development and creation.

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