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Methodology for Systematic Literature Reviewapplied to Engineering and Education

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Abstract— A survey of the relevant scientific literature is essential for generating research questions and defending the need for more study in a certain field. This is a difficult task for those who are just starting out in the area of scientific research because they lack the experience necessary to search and filter material effectively and the knowledge of which comprehensive databases are essential for their research. We suggest a modification of the approach used by Kitchenham and Bacca, which breaks down the procedure into three stages—preparation, execution, and reporting of findings—to guide the researcher from "my" to "the" present condition of the issue. Three to five research questions and a "mentefacto conceptual" are derived from the research issue approach in the pre-analysis phase; the latter adds creativity to the procedure and makes it easier to build a thesaurus for searches and inclusion/exclusion criteria. In the beginning stages of a research project, it is necessary to conduct a basic systematic study in order to discover previous work in the field, examine the relevant literature, and, if any findings are identified, check whether they provide an answer to our research questions. Inclusion and exclusion criteria, both broad and narrow, as well as supplementary factors, were created as part of the search strategy development process. If the procedure is carried out thoroughly, the researcher will get a list of high-profile publications in the field, as well as specific information on the papers that pertain to each subset of research topics. Each step of the process has been exposed in a study case for easy exposure, and the results back up the ideaMethodology Educational engineering Systematic literature review

INTRODUCTION

Reviewing the relevant scientific literature systematically is crucial for generating research questions and providing a rationale for further study in a given field [1]. In the academic world, especially for first-year PhD candidates, research in a specific area and who need a methodical approach to learn the work carried out to date, the methods that have been used (population, sample, statistics), the results obtained, the proposals put forth by the authors, and of course, to ascertain who the leading authors in a field are and what databases and publications they use to present their work, so that they can learn how to obtain updated and permanent information on the dynamic results published There is also a lack of awareness of the journals and spaces for scientific dissemination where researchers with similar research fields, problems, and objectives are interacting and contributing by sharing their progress, results, methods, strategies, databases, networks, etc. Similarly, it may be challenging for a researcher to determine the key terms of search from a thesaurus, as well as the inclusion and exclusion criteria for filtering the results, whether he or she is embarking on a new field of study or seeking to supplement his or her existing area of work. A taxonomy is presented in [2], described in a table of several categories, subcategories, and sub-sub-categories/topics, which help to understand the scope of the field of study; similarly, they propose a taxonomy product of the crossing of four main categories, and breaking down from two diagrams, in the form of a horizontal tree with double entry (rows and columns), with many keywords, witho However, the search procedure is not clear from a list so broad While the original intention of De Zubira's [4] "mentefacto conceptual" was to aid in reading comprehension, we believe that its unique qualities and visually appealing layout make it well suited to meet the aforementioned requirements.

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In [5], the authors do a basic filtering by querying the Scopus database for the sole variable of "main topic; and, as discriminators, the date of publication." publishing, followed by a detailed examination of the compiled papers by each reader. The researcher is pleased with the results, but this is not a systematic review in the strict sense since there is bias in the search terms used and the analysis is incomplete because no inclusion or exclusion criteria were specified. Several techniques exist to overcome the aforementioned constraints and empirical practices by providing an in-depth explanation of the full systematic process of constructing a state-of-the-art. The ideas by Kitchenham et al. [6], used by the same author in the search for literature reviews in engineering [7], and then updated by Bacca et al. [8] and many thousand researchers have served as a guide for researchers over the last several years. They break it down into three stages: preparation, execution, and analysis. Based on earlier ideas [6], [7], the Kitchenham group at Keele University [9] develops the Guidelines for carrying out Systematic Literature Reviews in Software Engineering, tailoring them to the unique needs of Software Engineering while making them applicable outside that discipline. The researcher must have extensive background knowledge and expertise in the chosen scientific topic in order to use these methods effectively. Applying the approach of Kitchenham et al. [6, 7, 9] yields findings that are grounded in the research topic, research questions, inclusion/exclusion criteria, and associated analysis, as shown in the results. These benefits and potentials of enormous effect are inherited in this approach, inside the methodical search process, and are supplemented with components of conceptual thinking to ease the researcher's work. In order to make the first phase of a systematic review more efficient, we recommend enhancing the Kitchenham technique with this approach. There is also the establishment of a list of high-impact journals, which will serve as a forum in which the young researcher may publish their findings, make connections with experienced researchers in the field, and stay abreast of the latest developments in the field. Finally, the document provides an overview of the method's application to a real case, including the mentefacto conceptual framework, search word thesaurus, search scripts by database, research questions, inclusion and exclusion criteria, related literature reviews, analysis characteristics of the research question,

lists of related journals, results of the systematic review, and brief conclusions. This case study illustrates the usefulness of the methodology in practice, making systematic reviews easier to conduct. METHOD We followed Kitchenham's [6, 7, 9] and Bacca's [8] three-step methodology for a systematic evaluation of the literature: planning, performing, and reporting the review. New to the research process is the preliminary conceptual analysis, which is developed from an early approach to the general research problem; this conceptual analysis is executed in accordance with the proposal of the conceptual mind, created by De Zubira [4] or analysis and understanding of a particular field of study, based on a graphical model. The whole search organization and sifting through inclusion and exclusion criteria will be directed by this reference. After the aforementioned adjustments, the systematic review process consists of the following steps: Planning

Recognizing the need for a review (1.1)

The Existing Body of Knowledge About the Issue (1.1.1).

Questions for Study (1.1.2)

1.1.3 "Mentefacto Conceptual"

1.1.4 Systematic Reviews That Are Similar

Creating a Review Protocol 1.2.

Criteria for inclusion and exclusion are defined in Section 1.2.1.

Data Extraction Form Preparation 1.2.2 Journal Selection 1.2.3

Reviewing the Process

2.1. Finding relevant research 2.2. Choosing main studies

Evaluation of Research Quality 2.3

Extraction and tracking of data 2.5 Synthesis and tracking of data

3. Summarizing the findings

Fig. 1 Generalized Methodology Procedure

As indicated in Fig.1, the researcher begins with a "personal/individual" understanding of the topic

(labeled "'MY' Current State of the problem) and progresses to a more comprehensive understanding (labeled "'THE' Current State of the problem") by the conclusion of the research process. The researcher needs at least know how to create research questions and draw the mentefacto conceptual, in addition to knowing something about the topic and the field of expertise in which the literature review will be done. The first systematic search S() is performed using this foundation of information to identify any relevant systematic reviews that have been performed. Just in case a systematic

If a systematic review that addresses the research topics is not already available, one will be conducted.

Part of the second macroprocess is described by the steps that make up the Systematic Search Procedure S(). Search terms are culled from the mentefacto conceptual and scientific thesauri, a search semantic structure is developed, a script is written that is tailored to each database, a unique procedure is used to select studies, and the final output is a
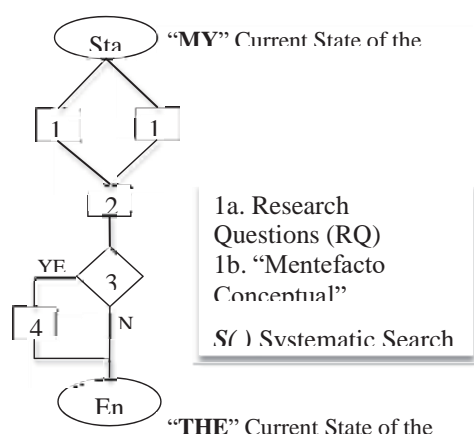
list containing the search results as a variable (see Fig. 2).

Words from thesaurus for semanticcriteria search

Semantic structure for searchingspecific papers

Search script (see syntax of each DB -WoS, Scopus, Google Scholar, others)
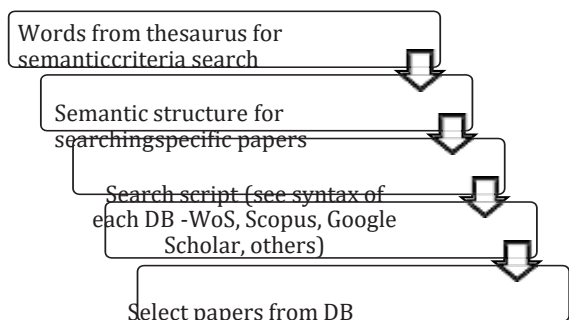
Select papers from DB

Fig. S(), the Systematic Search Method

A. Several processes are iterative and occur in continuous cycles until the objectives of each phase and sub-phase are fulfilled, making the overall process seem linear. Since the purpose of "Preferred Reporting Items for Systematic Reviews and Meta-Analyses" (PRISMA) [1] is to aid researchers in preparing systematic review reports by means of a 27-item evaluation checklist and a specific flowchart to follow [10], we adhered to its recommendations throughout the "Development of a review protocol" stage and in the final part for presenting the report. Each research topic in the suggested design must undergo at least one iteration. *Strategy 1) In-Depth Analysis of the Present-State of the Issue*

1. C. The systematic review of Literature begins with the research issue, since it is the beginning point of the whole scientific method. One should not pretend to construct a faultless formulation from the first instant, we must consider the personal and social component, and it needs to be done with sociological ideology, as suggested by Anger-Egg[11]. Hernández [12] makes some suggestions for how a research challenge in this area might be approachedStudy tools are the goal.

2. 2. queries for study.

3. Third, the study's justification: why and for what. from the research.

4. Study feasibility, number four.

5. Access to materials is the fourth category.

6. Limitations of the Research 4.2.

7. 8. The research's relevance and impact.

8. Disparities in understanding the issue

9. What we know today, section 9.1.

10. 9.2 Fresh viewpoints on the subject matter.

- Some of these 13 are gleaned from the systematic review, but the first one must be in place before proceeding. The researcher has to be able to not

only conceive the issue, but also articulate it in a clear, precise, and accessible manner, as Ackoff [13] reveals; in other words, there should be more opportunities to acquire a satisfying answer if the problem is posed appropriately. All the remaining steps in the methodical process are inputs, and they rely on the researcher's accurate approach to the topic and their clarity on this. *Issues for Further Study* Hernández [12] reveals that research questions are a part of the issue statement; these first questions are the ones that will lead the complete process, since they sum together the researcher's innate interests and the information that this individual has about the status of the particular field. According to Hienemann [14], the research question influences the research design and sets the anticipated outcomes, hence it is crucial to develop the research questions with clarity and explain the rationale for their formation at the outset of a study. In this approach, the research questions provide an initial point of guidance for what has to be examined and how. These are labeled and should be easily distinguished from the first set of research questions. RQ is the first letter in the labeling syntax, then the numbers, and finally the question's narrative proper. *What's the deal with the first question (RQ1)?*

- *What is the answer to the second question, RQ2?*

- *What is the answer to the last question?*

- *If the search for systematic reviews reveals that any of the initial research questions have been addressed by the findings of a previous study, then the original list of research questions may be trimmed. If the question were only partly answered, it may be kept but the categories used to analyze it could be altered. In order to strike a good balance between the breadth of your research and the complexity of your answers, Kitchenham suggests composing between three and five research questions.*

Conceptual Mentefacto

De Zubiria [4] created the conceptual mentefacto as a tool for effective reading and learning. Concepts may be represented with the help of Conceptual Pedagogy's mentefacto conceptual. According to the author, it is a "graphical sketch" that presupposes a complicated notion and conceptualizes it via representation. The heart of this process lies in the answers to four questions. Which category does it fall under? How do you differ from other things that look like you? And are there several varieties of you? The framework of the ideas is built from these queries, with four clusters of thinking emerging as a result:

First, excluded; second, superordinate; third, infraordinated; and fourth, isoordinated, as indicated in Fig. 3. The isoordinados highlight critical components; the superordinados

concept; excluded, indicate the closest conceptions to the concept; and infraordinates, indicate the classes and subtypes of the concept.
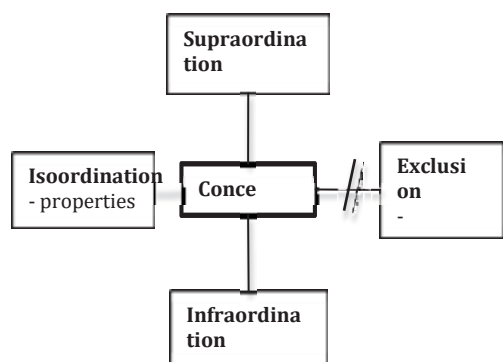
Fig. 3The "Mentefacto conceptual" [4]

The search terms, which are typically located on the left side of the ideogram (Isoordination), will be deduced from the ideogram. Given that an investigation into a subset of the idea would likewise fall under its aegis, we also take into consideration the subclasses (Infraordination) when selecting keywords. Exclusion and supra ordination data are taken into account for the analysisof the criteria for inclusion and rejection.

4) Systematic Reviews That Are Related

Search Scripts for All Databases (Table I)

Initial bibliographic research for the mentefacto graph model entails doing a rudimentary systematic investigation to locate work reviewing the relevant literature and, if such work is located, to ascertain whether or not the resulting findings answer our research concerns.Input for the production of the semantic structure of search for papers is derived from the search terms, which are derived from the modelo conceptual and connected to the thesaurus of the domain of science to establish words that signify synonymy and antonymy. The search structure shown in Table I will be modified into a script specific to each database. In the end, the publications that made it through the researcher's subjective standards are sorted into three groups: legitimate, referents, and responses. The purpose of this section is to emphasize whether or not the literature reviews identified enable us to answer the research questions that we have posed in our issue; if so, this study is used to back up our research proposal. Otherwise, the unsolved research topics will be labeled and categorized to allow for a systematic continuation of the first bibliographic study.

Review protocol creation

Criteria for inclusion and exclusion must first be defined.

The dearth of systematic review studies that address the research objectives and their categories of analysis conditions this and the

subsequent sub-stages of the Development of a review process. This step is broken down into general, particular, and supplementary criteria that take into consideration research topics, as explained by Bacca et al. [8]. In addition to considering the included groups, one must additionally

Adjustable variables based on theoretical studies, worldwide norms, and research techniques are built up for each component.• (synonym_m* OR keyword_m*)

Filters that operate in parallel: (year > (this year -5 years)

Review, Keyword_1 OR Synonymous_1; Keyword_2 OR Synonymous_2; Keyword_3; Keyword_4; Keyword_5; Keyword_6; Keyword_7; Keyword_8

Adjustable variables based on theoretical studies, worldwide norms, and research techniques are built up for each component.• (synonym_m* OR keyword_m*)

Filters that operate in parallel: (year > (this year -5 years)

Review, Keyword_1 OR Synonymous_1; Keyword_2 OR Synonymous_2; Keyword_3; Keyword_4; Keyword_5; Keyword_6; Keyword_7; Keyword_8

equivalence_n_2 OR equivalence_n_m
Keyword_1, OR synonym_1, OR keyword_2, OR synonym_n, OR synonymous_n_1, OR synonym_n_2, OR review, study,

1)   *1) Creating a data-gathering template*

2)   *The researcher must set up the systems that will be used to catalog the collected data. You need to define and set up areas for storing tools and displaying results, suchsynonymous_n_m*

3)   *Article Title, Abstract, Keywords, and Year Are Used As The Primary Filters.(this year minus five)*

4)   *(keyword_1 OR interchangeable_term_1) AND*

5)   5) in the forms of digital spreadsheets and reference organizers.

6)   It is recommended to utilize a bibliography management application like Mendeley to organize and

categorize search results for scholarly literature.

7)   Scopus

8)   Papers and other documents emerging from the search are also required, with cloud storage being a viable alternative for group projects and last-minute plans. *Journals Chosen*
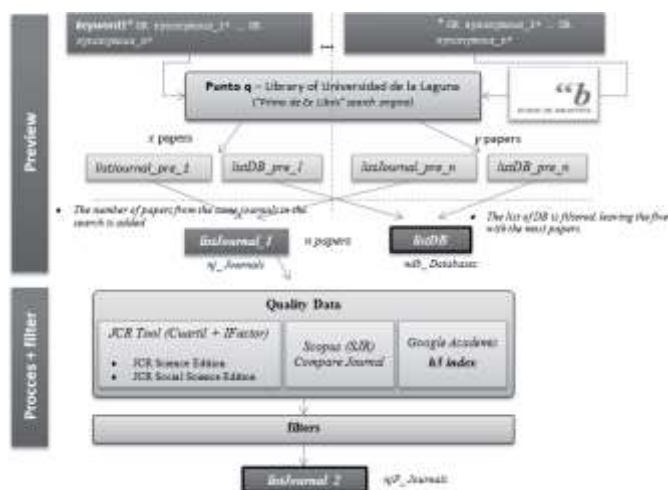
Fig. 4. *Flow chart for selecting relevant journals*

A process flow chart to help choose appropriate journals has been developed. "Primo de Ex Libris" (licensed to the library at the Universidad de La Laguna) is utilized for this preliminary curation using the platform's search engine, "Punto q"1. Lists for journals and databases (listJournal_pre_1 to listJournal_pre_n and listDB_pre_1 to listDB_pre_n, where n is the number of searches) are generated automatically by the platform. This study, like other scientific investigations, draws on a variety of fields of study to reach its conclusions. In this phase, we will be looking for the highest impact journals. To this purpose, we suggest the systematic search, in which a search structure is implemented using a semantic sentence2 that unites the study disciplines utilizing terms identified in a scientific thesaurus, to locate research in the areas in question using keywords. This filter helps us zero in on the publications and online resources that are relevant to our studyColumns for the Journal Citation Reports (Impact Factor, Quartile in Category, and Category) as well as the Science Citation Reports (h-index), and the Web of Science (WoS) may be found in the first journal list (listJournal_1). listJournal_2 is the outcome of applying the filter of sorting. The following selection criteria may be usedFormula for where sortingOrd = (number of research articles * 25%).(JCR IF).(SJR).(h-index #5)

B. To ensure that this variable is consistent with the other three factors, we have set it to 25%, which is the quantitative proportion of articles acquired in the journals.

C. • The list must be purged of any and all periodicals that aren't directly related to the field of study. A few examples:

D. o The JCR takes into account the following areas: Science of Computing, Computer Science: Interactive Applications

E. - Information Science and Related Fields; Pedagogy, Psychological Studies, and Related Areas; Special Education; and Rehabilitation.

F. o "Education Technology," "Education," "Human Computer Interaction," and "Engineering & Computer Science (general)" are all categories in the h5 index.

G. As a last criterion, the "Aims and Scope" portion of each journal's online home must be reviewed.

H. • Discard any periodicals that aren't included in the JCR or SJR indexes.

I. Following the earlier-provided Ord formula, just the top twelve journals on the list need be retained.

J. • The journals must be separated into two piles—JCR Science Edition and JCR Social Science Edition— according to their categorization in JCR 2016.

Review Methodology (M): Execution As described by Kitchenham [7], the review itself may begin after the technique has been settled upon. Step one's inclusion/exclusion criteria and journal list are required for this one to work. (*listJournal_2*). Some of the procedures to follow here are detailed in Fig. 2. *Systematic Search Procedure S( )*, which were also applied in the planning phase, in Related SLR. This stage includes 5 sub-stages that are detailed in Kitchenham's [7] proposal, with the adaptations of the new method.

All the sub-stages that involve the review are iterative and incremental, so the process will follow as many times as the researcher considers necessary until the research questions are answered.

1) Identification of research

This first sub-stage complements in some way the protocol exposed in the previous phase. Involves activities such as establishing search strategies, publication bias, bibliography management and document retrieval, and documenting the search. As search strategies, the first three stages of *Systematic Search Procedure S( )* apply: 1) Words from thesaurus for semantic criteria search; 2) Semantic structure for searchingA semantic sentence is used to consult databases through structured query languages (SQL). specific papers; and 3) Search script. Here, the hard search is performed on the selected databases; it is suggested to do it in It is possible to narrow down the list of previously received journals by using WoS, Scopus, and Google Scholar as a filter.

To do a continuous search in all of the journals and to arrange the results based on the structure of the variables from research questions, the "Knowledge Discovery in Databases" (KDD) approach [15] is proposed. Structured search concepts are used to the semantic organization of queries; the logical gates AND, OR, NOT, SAME, and others aid in effective filtering. The example shows how AND may be used to combine search parameters, OR to create a list of synonyms from the previously defined thesaurus, and NO to exclude unwanted terms.

It is recommended that a bibliography management tool be used to organize the search results from scholarly databases, such as Mendeley3, Zotero4, Endnote5, or another that the researcher considers. Bibliographic software is a great tool for organizing the many citations that might result from studying the available literature.

When discussing the issue of publication bias, it is important to note that the idea of good or bad outcomes might often rely on the opinion of the researcher [7]. Google Scholar searches help reduce bias to some extent,

but it should be noted that high-quality state-of-the-art research must ultimately rely on studies supported by reputable academics, such as the editors and reviewers of high-impact journals featured in the top quartiles of the JCR and SJR indexes.

Method Two: Choosing Primary Research

When the bibliographies have been completed, the corresponding full articles may be retrieved. Each member of the research team needs their own login to the bibliography management system so that they may access the administration and make decisions about which publications to pick together. The goal of the study selection criterion [7] is to isolate the main studies that answer the research issue. During the protocol formulation phase, the selection criteria that will be used to minimize bias are determined; these criteria will serve as a road map for the rest of the process and will be what separates a systematic review from a more conventional one. Decisions on which texts to include or exclude should be made after reading them in their entirety.

Each document requires tagging, downloading, and depositing in a central repository. The recommended syntax for cataloging digital files is as follows:

2) Research into gestural environments, such as RQ2_01_SSE3_2013_Torres_Usabity, where:

    3) Question No. 2 in the Study

4) First chosen paper; referred to here as "01."

5) Journal ID from the Social Sciences E3 List.

6) Also, the citations should be saved to your computer and added to your bibliography software. Tags: (RQ1, SSE1, SLR), and then add the necessary information to the Notes section of the application, as shown in the previous example. In addition, the chosen document has to be tabulated in the electronic record sheet so that it may be used in statistical analysis.

7) 2) Evaluating the Standard of Studies

8) This section builds upon the one before it. Assessing the "quality" of source publications is typically regarded as significant, in addition to conventional inclusion exclusion criteria [7]. The inclusion and exclusion criteria provide further support for these factors by including measures of quality such as the significance of the study, the reliability of the cited references, the expertise of the authors, and the renown of the journal in which the research was published. Guidelines from the Australian National Health and Medical Research Council and the Cochrane Collaboration are cited in [7] for suggesting that study design is considered during assessment of evidence rather than during the appraisal and selection of studies.

9) You may easily determine an article's significance with the use of databases and search engines like Scopus, WoS, Elsevier's ScienceDirect, and GoogleScholar. Sites like Scimago (SJR) and Journal Citation Reports, index h5 of Google Scholar, have a bibliometric detail of all journals indexed in its database; variables like: h index, impact factor, and dating trend, will greatly assist in establishing the quality of the journal and thus its ranking. Having completed a thorough assessment and cataloguing of journals in advance, as part of the methodology's approach, the needs of this stage are addressed in significant part.

Eleven) Collecting and keeping tabs on data

Information gleaned from primary studies must be recorded carefully, therefore researchers must draft data extraction forms with fields for things like review name, date of data extraction, title, authors, journal, publishing description, and any other remarks they may want to include [7]. If utilized properly, the current bibliographic management software (discussed in section B1) should be sufficient to complete this substage, even if working from a group of researchers. How they occurred, how they interacted, and how they were identified

data registration, will make the procedure more productive and efficient. Documents should be marked as part of the literature review and the related research topic in the keywords area, and related comments should be documented in the notes section. Find the sources that are relevant to your research issue and use them as a starting point for your literature reviewSynthesis of Data and Continuous Tracking

The systematic review's quality is established in this last phase. The synthesis may be descriptive (non-quantitative) in nature, or it may serve as a quantitative summary to supplement a descriptive synthesis (in which case it is a meta-analysis) [7]. Kitchenham also details, depending on whether the analysis is qualitative or quantitative, what features it should include.

Review Summary (M)

All findings must be shared with the scientific community for assessment and comment. When it comes to arranging research findings across time and between disciplines, the outcomes of a systematic review are highly anticipated. It is always included with a PhD thesis and may be presented at a conference or published in a scholarly publication [7].

I. Kitchenhand [7] recommends include the following information in the systematic review report:

II. 1. Title.

III. 2. Authorship.

IV. 3. Context, Objectives, Methods, Results, and Conclusions, often known as an Executive Summary or Structural Abstract.

V. 4. Background.

VI. There has to be a detailed description of each review question.

The Case Study: XVI.

A high-level overview of how each phase and sub-phase fits into the research process is provided to both validate the approach and provide context for the researchers. The 2017 PhD thesis [16, 17] also includes an evaluation of the technique, which was found to be successful. The new parts are introduced to the Kitchenham approach by means of a synopsis of the revising effort. Children in Inclusive Classrooms Benefit from Gestural-Computer Interaction

been selected as a generic setting, a functional domain, in which to demonstrate the technique.

A. Planning 1) Research on the Existing State of the Problem

In Human-Computer Interaction (HCI), Computer Science, Gestural Interaction has been regarded a study topic; it is a subarea of the natural interaction (NI). As more and more individuals with disabilities need specialized hardware and sensors to use computers, studies in HCI are becoming more important to the technology

L1 Gestural Computer Interaction

CONCLUTIONS

This article introduces a fresh approach to systematic review, including how to plan, execute, and report on such a study. Kitchenham's original technique, Bacca's modified version of it, and De Zubrá's ideogram for a conceptual mind map, mentefacto, all lend credence to this approach. Particular attention is paid to how the mentefacto was modified.Learning

A. Performing the analysis

For each article in JournalList_2, a search was conducted using the Expert Search capabilities on Elsevier's ScienceDirect platform, using the parameters specified in the following script. Based on the results of the first search, we further subdivided our areas of focus into five categories to help us identify the most relevant scientific publications. The indexing scheme may be used with the WoS system.

theoretical, serving as the cornerstone upon which to

industry as a whole. Using IN, the user is able to deliver instructions to the computer using natural and intuitive means, such as voice commands, hand, finger, arm, and body motions, and even indirectly through bio-physiological data recorded by wearable sensors [18]. Gesture interfaces, on the other hand, employ human body parts as input controllers for a computer, such as the limbs (arms, hands, fingers), the trunk (torso, neck, and face), and the extremities (legs, feet)[19]. Knowing and organizing the outcomes of research in this subject is important since digital teaching tactics derived from gestural interaction settings have been proven to significantly increase the learning of persons with cognitive disorders [17], [20].

2) Investigative Queries

☐ From the exposition of the problem, and as a requirement for future research the following research questions have been proposed:

☐ • RQ1: In what ways have strategies for gestural engagement in educational settings been implemented?

☐ How have the pedagogical materials for gestural communication been developed?

☐ Which technologies for gestural engagement have been implemented in schools?
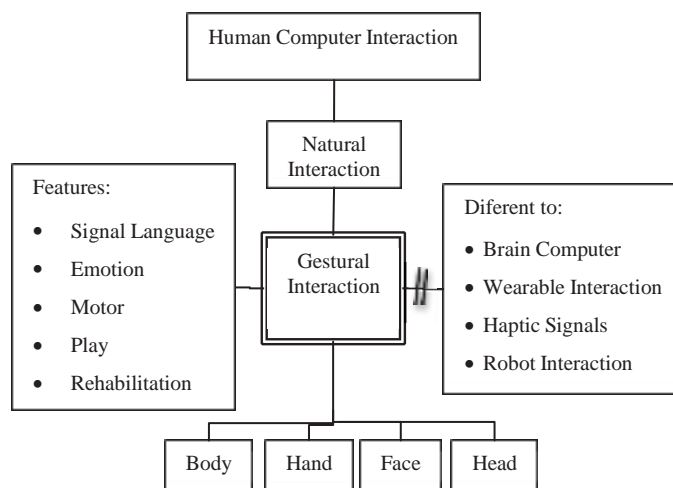
☐ One) Conceptual Mentefacto

Fig. 5. *Mentefacto Conceptual – Gestural Interaction*

build the search terms, their antonyms from the scientific thesaurus, the semantic framework for navigating through academic publications, and the database-specific search script.

A case study is used to illustrate each step of the process. The establishment of the search script in the databases has been delayed while we prioritized the application of the mentefacto conceptual framework.

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