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What kind of intuition for what kind of education: A scoping review*

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Quale tipo di intuizione per quale genere di educazione: una scoping review

The general purpose of this scoping review is to investigate the role of intuition in Higher Education. In particular, it aims to understand the contribution of intuition to achieving disciplinary objectives. The review method used is that of Arksey and O'Malley, of a qualitative type, the data were extracted in an "analytical-descriptive" mode, in order to detect the profound meaning of the content present in the reviewed articles. The qualitative-interpretative approach and the thematic analysis of relevant parts of text have made it possible to grasp the essence of educating by means of intuition. ERIC, Education Source Ultimate, Scopus, Web of Science, APA PsycArticles are the electronic databases consulted, 2020-2024 are the years considered. The results show that STEM disciplines are more interested in the educational dimension of intuition and conceptualise it according to psychological or neurological theories; they find it useful in experiential learning for training expert intuition through visual elements. The disciplines related to humanities prefer, however, to train creative intuition, imbued with emotions, through readings and discussions in a small group.

La finalità generale della scoping review è di investigare il ruolo della intuizione in Higher Education. In particolare, mira a comprendere il contributo dell'intuizione nel conseguimento di obiettivi disciplinari. Il metodo di revisione è quello di Arksey and O'Malley, di tipo qualitativo, i dati sono stati estratti in modo "analytical-descriptive;", al fine di rilevare il significato profondo del contenuto presente negli articoli revisionati. L'approccio qualitativo-interpretativo e l'analisi tematica di alcune parti di testo hanno permesso di comprendere il senso dell'educare attraverso l'intuizione. ERIC, Education Source Ultimate, Scopus, Web of Science, APA PsycArticles sono i database elettronici consultati, 2020-2024 gli anni considerati. I risultati dimostrano che le discipline STEM sono più interessate alla dimensione educativa dell'intuizione e la concettualizzano secondo teorie psicologiche o neurologiche. L'apprendimento esperienziale risulta utile per allenare l'intuizione esperta attraverso elementi visivi. Le discipline più vicine all'area umanistica preferiscono, invece, allenare l'intuizione creativa, intrisa di emozioni, attraverso letture e discussioni in piccolo gruppo.

Keywords: Intuition; Educational design; Experiential learning; Visual elements; Higher education.

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1. Introduction

It is very complex to provide a single definition of intuition since, considering its interdisciplinary nature, different disciplines have developed their own conceptualisation. It would therefore not be possible to offer here a comprehensive summary of all various definitions of intuition and its components that have been developed over time, efforts to reconcile these have been documented elsewhere (Sinclair, 2011). However, it is possible to highlight a few attempts that the reference literature has made in order to develop a concept of intuition that could be shared by different disciplines. One of the recent attempts to identify the underlying features and components of the construct dates back to 2005 (Sinclair & Ashkanasy, 2005); combining management theories with those of psychology, it defined intuition as non-sequential information processing, which includes cognitive and emotional elements and results in direct knowing without any use of conscious reasoning. Another attempt at an interdisciplinary conceptualisation of intuition involving management theory, psychology and philosophy was made in 2007 by Dane and Pratt (2007). These authors view intuition as affectively loaded judgements that derive from rapid, non-conscious and holistic associations. The authors of both definitions agree that intuitive and rational thought process information in a different way: linear-sequential for the rational and holistic-associative for the intuitive. The attribute of the holistic associative is not, however, present in philosophy as it is evident from the thought of Descartes (1637/1998), post-Cartesian philosophy (Locke, 1690/2006; Spinoza, 1677/2007) as well as phenomenology of intuition developed in the 1900s (Husserl, 1900/2015). For these philosophers, intuition does not extract a possible representation from an infinite range of possibilities, but rather captures an objective characterisation of the setting of the real problem. In psychology, dual-process theories have, however, underlined the duality of human cognition, which is realised in two types of processing: intuitive (type 1) that is unconscious, rapid, automatic and high-capacity, and rational (type 2) that is conscious, slow and deliberative (Epstein, 1994; Evans, 2010). These theories consider holistic associations an attribute of intuitive processing. For philosophy, on the contrary, intuition and rational thought are not two incompatible entities because intuition represents the basis on which any form of deliberative reasoning proceeds. Moreover, unlike philosophical thought, psychology and management consider emotions and affect an important component of intuition (Epstein, 1994; Hogarth, 2001).

In addition to the conceptualisation developed by some disciplines, scholars such as Johann Heinrich Pestalozzi (1928), Jean Piaget (1983), Paulo Freire (2022) and Jerome Bruner (2016) highlighted the educational role of intuition in learning processes not only for children but also in adult education. In the educational field the function of intuition was underlined in relation to learning about problems as they can stimulate reflection and identification of possible solutions. In particular, intuition in educational research, as mentioned by Luigina Mortari and colleagues (2024), is a cognitive act that identifies the eidetic essence and as such allows the mind to grasp the invariant essence of a phenomenon in upstream way.

Furthermore, in high-stakes and specialised fields such as education, business management and engineering it is posited to be an essential component of the development of disciplinary expertise. In these areas intuition supports decision-making as it is considered a precondition for the development of any high-level competence. For some scholars (Chi, Glaser, & Farr, 1988; Dreyfus, 2004) an expert is able to find intuitive situational responses and has a strong ability to build associations or perform mental simulations that can be acquired through experience. According to these disciplines, responses to the same problems are governed by decision-making processes and may be arrived at through rational, intuitive or emotional means. In education disciplines, it is considered important for the decision-making of teachers as they often find themselves managing complex class situations in split seconds. In fact, some scholars (Sipman, Thölke, Martens, & McKenney, 2019) make reference to the teacher's intuitive pedagogical tact, understood as competence drawing on a balanced awareness for receiving and dealing with input, as a result of pedagogical actions that produce desired outcomes in class. In business management, intuition is often applied to deal with ambiguous and complex problems. This discipline has recently identified educational and training methods for intuition development with particular attention to the "brain" (i.e. cognitive aspects) and to the "body" (i.e. the emotional, interoceptory, sensory, somatic and visceral aspects) (Fellnhofer, Sadler-Smith, & Sinclair, 2023). The discipline of engineering considers, in

turn, intuition as the ability to assess solution (or response) feasibility and to predict outcomes and/or options in a scenario.

In view of the interdisciplinary nature of intuition and its educational dimension, the general purpose of this scoping review is therefore to investigate its role in Higher Education, particularly in colleges and universities. Specifically, we intend to gain an understanding of the context-specificity of intuition in various academic disciplines, what kind of educational design is suitable to improve its use and what implications it has for competence/expertise development in various professions. In light of the aforementioned definition inconsistencies, we decided to investigate also how intuition is conceptualised in the represented disciplines.

The main question guiding our research was thus formulated as: What is the educational dimension of intuition in Higher Education?

This was supplemented by more specific associated questions:

- RQ1. Which concept of intuition is prevalent in certain academic disciplines?
- RQ2. What is the reference population for the Educational Design (ED) proposed and/or implemented?
- RQ3. What are the research methods used by the authors of the reviewed articles?
- RQ4. What are the educational objectives of the ED proposed and/or implemented?
- RQ5. What kind of design has been adopted in the ED?
- RQ6. What are the key findings achieved or intended by the ED (depending on whether the ED was only proposed or also implemented)?

This type of review has been used successfully in similar studies previously, in particular this approach allowed a comprehensive identification of key trends in a field of research, in order to summarise existing knowledge and uncover gaps (Arksey & O'Malley, 2005). The review method is of qualitative nature and, as suggested by Hilary Arksey and Lisa O'Malley (2005), the data extraction method is "analytical-descriptive"; it is not a simple summary of relevant parts of the analysed articles but rather a qualitative analysis of the content that reveals the richness of the extracted data (Levac, Colquhoun, & O'Brien, 2010). The objective of this review differs from a systematic review of literature in that it does not evaluate the quality of the included studies, instead it requires a reinterpretation of the reviewed literature (Ghirotto, 2020). Through the thematic analysis of relevant parts of text of the reviewed articles it was possible to identify information that offered adequate answers to our research questions. The qualitative-interpretive approach allowed us to rediscover the meaning of educating (Bruzzone, 2023), in this case through intuition. This is in response to the risks of education being distorted and becoming an opaque operation if its ultimate goals are forgotten or neglected (Bruzzone, 2023). By investigating the educational dimension of intuition and underlining how intuitive knowing can surface through emotions and feelings, we hope to go beyond learnification with the aim to promote greater creativity in ED. The thematic analysis of the information detected in the reviewed articles allowed to identify some salient elements of the educational design in which intuition is considered useful for the achievement of specific disciplinary objectives. The aim of this review is not to analyse frequency with which certain themes appeared but the salience and meaning of the underlying dataset.

2. Design and Methods

Our review followed the five-step framework outlined by Arksey and O'Malley (2005): the research question, identifying the relevant studies, study selection, charting the data and collate, summarise and report results. Data were extracted from all selected articles through careful and in-depth reading, performed repeatedly by both researchers. The choice of articles considered eligible and of interest for this scoping review was carried out with great rigour and attention, considering the complex nature of the subject matter of the review. In particular, the criteria followed in data extraction included only those

articles whose authors developed their own conceptualisation of intuition or used a definition of intuition developed by other scholars. Furthermore, only those articles were selected that designed and/or implemented an ED to achieve specific disciplinary objectives in which intuition plays a key role. It was therefore necessary to analyse the objectives, design and key findings of each ED before evaluating their congruence with the objectives of this review. Attention was placed on those paragraphs in the reviewed articles, in which the educational dimension of intuition was made explicit, either through the ED proposal alone or also through its implementation. For this reason, the scoping review followed the tenets of an integrative review that collects information from both empirical and theoretical publications. This way, it was possible to combine academic reflection with professional practices conducted in educational contexts (Mortari, Pizzato, Ghirotto, & Silva, 2021).

2.1. Stage one: The research question

The research question aims to guide the employed search strategy. In particular, we tried to understand what concept of intuition the authors of the reviewed articles used to guide their educational design for the achievement of specific disciplinary objectives. We also tried to understand its implications for professional development.

2.2. Stage two: Identifying the relevant studies

As recommended by Arksey and O'Malley (2005), a detailed search of the sources was carried out in order to identify the relevant studies that can provide answers to the research questions. For this reason, a systematic search was conducted in various electronic databases, selecting articles according to the international PRISMA-SCR guidelines and providing a Population, Concept and Context (PCC) framework to better address the review questions and maintain coherence of the search strategy. Specific inclusion and exclusion criteria were also identified that guided the search and selection of articles. Only peer-reviewed articles were selected, written in English, published between 2020 and 2024 (Table 1). We have chosen to review articles published in this timeframe because we wanted to understand what has been done in recent years in the field of Higher Education when intuition training and development started receiving more attention in the academic literature. The article selection activity ended at the end of February 2024, and it was thus possible to review also those articles published in the first months of 2024. In fact, our review includes one article from 2024.

Table 1 – PCC and Inclusion and Exclusion Criteria

Population	Students (e.g. especially university and college students).
Concept	Only heuristics in Higher Education, intuitions, gut feeling, intuitive thinking, intuitive competence, intuitive judgment, concepts of intuition in academic disciplines.
Context	Higher Education, Educational Design (e.g. objectives of design mode, key findings).
Inclusion Criteria	Peer-reviewed theoretical and empirical studies with a clearly defined concept of intuition and an Educational Design proposal. Mixed research methods were used: only planning and presentation of Educational Design, or planning and implementation of Educational Design, using quantitative and qualitative methods to evaluate the objectives achieved by students or to evaluate the quality of the implemented Educational Design. The years taken into consideration in the review: 2020–2024. Articles published in the English language.

Exclusion Criteria	Theoretical and empirical research aimed exclusively at the final evaluation of intuition. Non-peer-reviewed literature sources such as documents from government and non-government organisations, conference proceedings, academic dissertations, books and book chapters. Systematic review, literature review, scoping review. Articles published before February 2020.

Five databases were consulted for the scoping review: ERIC, Web of Science, Scopus, Education Source Ultimate and APA PsycArticles. ERIC and Education Source Ultimate were selected due to the purely educational dimension of the topic of interest. Moreover, these represent the world's largest and most comprehensive full-text research databases designed for education students, researchers, professionals and policymakers. All databases were consulted from August 2023 until the end of February 2024. Search terms were adjusted for each database to maximise comprehensiveness. With regards to APA PsycArticles and Education Source Ultimate databases, the only search options entered before screening were Boolean/Phrase and Apply Equivalent subjects. Before each screening, the option to select only peer-reviewed articles was added (Table 2).

Table 2 - Search Strategy

Database	Search terms	Results
ERIC	TITLE-ABS-KEY (intuition) OR TITLE-ABS-KEY (intuitive understanding) OR TITLE-ABS-KEY (intuitive thinking) OR TITLE-ABS-KEY (gut feeling) OR TITLE-ABS-KEY (intuitive competence) OR TITLE-ABS-KEY (intuitive judgment)	433
Education Source Ultimate	Boolean/Phrase-Equivalent Subjects: TITLE-ABS-KEY (intuition and higher education) OR TITLE-ABS-KEY (intuitive understanding and higher education) OR ABS-KEY (intuitive thinking and higher education) OR TITLE-ABS-KEY (gut feeling and higher education) OR ABS-KEY (intuitive competence and higher education) TITLE-ABS-KEY (intuitive judgment and higher education)	620
Web of Science	TITLE-ABS-KEY (intuition and higher education) OR TITLE-ABS-KEY (intuitive understanding and higher education) OR TITLE-ABS-KEY (intuitive thinking and higher education) OR TITLE-ABS-KEY (gut feeling and higher education) OR TITLE-ABS-KEY (intuitive competence and higher education) OR TITLE-ABS-KEY (intuitive judgment and higher education)	720

Database	Search terms	Results
Scopus	TITLE-ABS-KEY (intuition AND higher AND education) OR TITLE-ABS-KEY (intuitive AND understanding AND higher AND education) OR TITLE-ABS-KEY (intuitive AND thinking AND higher AND education) OR TITLE-ABS-KEY (gut AND felling AND higher AND education) OR TITLE-ABS-KEY (intuitive AND competence AND higher AND education) OR TITLE -ABS-KEY (intuitive AND judgment AND higher AND education)	178
APA PsycArticles	Boolean/Phrase- Equivalent subjects: TITLE- ABS-KEY (intuition and higher education) OR TITLE-ABS-KEY (intuitive understanding and higher education) OR TITLE-ABS-KEY (intuitive thinking and higher education) OR TITLE-ABS-KEY (gut feeling and higher education) OR TITLE-ABS-KEY (intuitive competence and higher education) OR TITLE-ABS-KEY (intuitive judgment and higher education)	187
Total		**2138**

2.3. Stage three: Study selection

The article selection was done systematically following the inclusion and exclusion criteria presented in Table 1. The flow chart of this scoping review (Figure 1) shows that the research produced 2138 documents identified through electronic databases. After the removal of duplicates using the Covidence software, 1839 articles remained. From these, excluded were publications in other languages than English and document types different from articles. This resulted in 1053 articles. Further exclusions were based on the following criteria: lack of congruence with the reviewed population; only theoretical research without proposed ED congruent with the objectives of this review; irrelevant topic and/or studies that investigated a congruent topic but differently from the provisions of our review objectives. Importantly, excluded were also those articles which, despite having designed and/or implemented a relevant ED, did not clearly define the concept of intuition. As a final result, this scoping review includes five (5) articles.

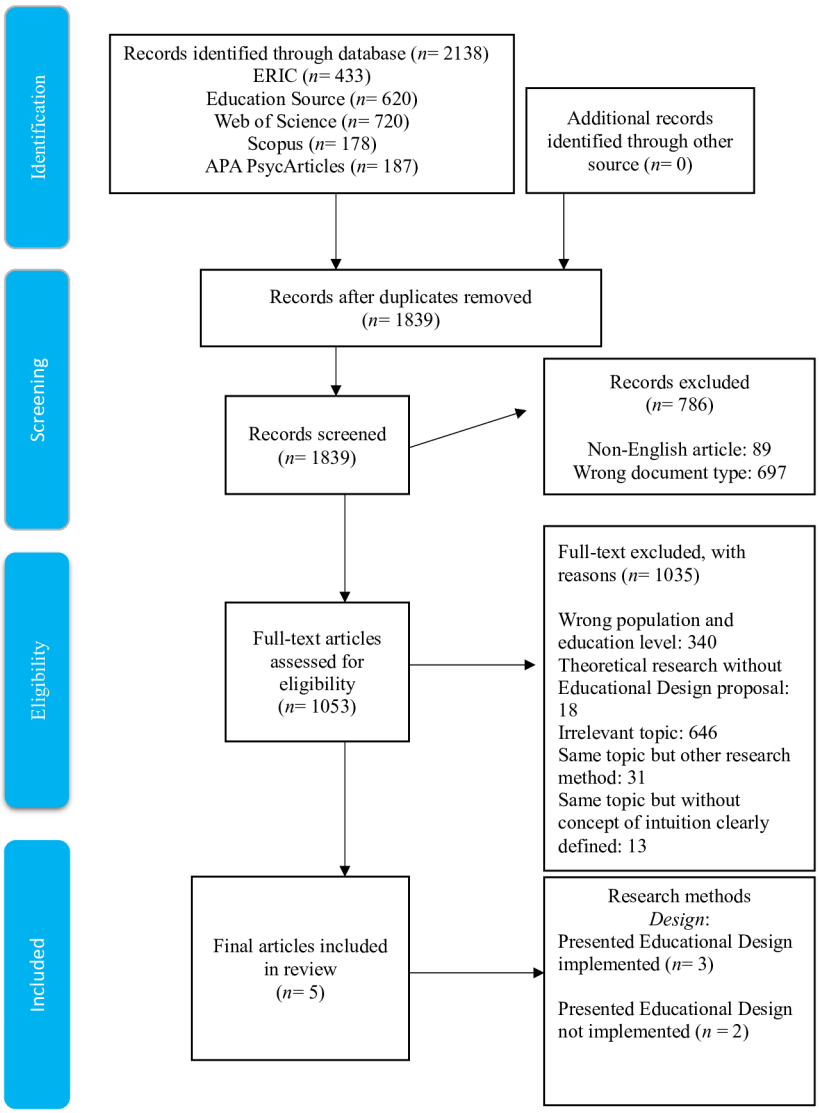

Figure 1 - Flowchart of the Scoping Review

2.4. Stage four: Charting the data

This fourth stage presents articles included in the review organised by author(s), setting (i.e. the academic courses in which the educational design was conceived or even implemented), the reference population, the research methods used by the authors of the articles to present their educational design and the performed related procedures. From each article, the salient elements have been selected that better present information already partly mentioned in the PCC and that help to understand the environment in which the educational design was developed (Table 3).

Table 3 - Salient Elements of Reviewed Articles

Author	**Setting**	**Population**	**Research Methods**
Zhou	Proposal for the establishment of Translation Ethics	Students of a Translation School (n = --)	*Design*: Presentation of ED *Procedure*: ED presented but not implemented.
Ji *et al.*	Civil engineering courses	Students from different universities, but always engineering (n = --)	*Design*: Presentation of ED *Procedure*: Demonstration of the conceived approach on two examples. ED not implemented.
Dart *et al.*	"Structures and Design 1" course in civil engineering	University students of civil engineering (n = 275)	*Design*: Mixed method *Procedure*: Demonstration of ED implemented and final student evaluation (quantitative and qualitative methods). ED implemented.
Kryjevskaia *et al.*	Calculus-based mechanics course	University students of physics (3 universities with total n = 517)	*Design*: Mixed method *Procedure*: Demonstration of ED; pre-test data, "intervention" data and post-test data; student evaluation of intervention (quantitative and qualitative method). ED implemented.
Cupchik *et al.*	Industrial design workshop	Students of industrial design (n = 39)	*Design*: Mixed method *Procedure*: Presentation of the workshop and final evaluation of the students (quantitative, qualitative method). ED implemented.

2.5. Stage five: Collate, summarise and report results

This final stage requires a qualitative description, in order to summarise and synthesise the data. Thematic analysis was used to code and classify the concepts identified in this study.

Table 4 maps the selected articles based on the author(s), the conceptualisation of intuition developed by the authors or adopted from other scholars and the involved disciplines (Table 4).

Table 4 - Concept of Intuition and Involved Discipline

Author	Concept of Intuition	Discipline
Zhou	Intuition is preconscious, holistically associative and affect-laden (Sinclair & Ashkanasy, 2005).	Translation ethics
Ji *et al.*	Intuitive interpretation means that an equation, an observation or structural behaviour can be explained in a simple manner while capturing the physical essence of the problem. In structural engineering, intuitive interpretation is an effective tool to explore new meanings, seek new connections, develop new understanding and promote wide and creative applications. Intuitive interpretation can best be illustrated using examples.	Civil engineering
Dart *et al.*	Errors and misconceptions of students stem principally from the lack of conceptual understanding. Intuition, as higher-level understanding, is a critical skill for practicing engineers who are expected to instinctively and spontaneously apply their judgement to engineering problems.	Civil engineering
Kryjevskaia *et al.*	Intuition is "nothing more and nothing less than recognition" (Kahneman, 2011).	Physics
Cupchik *et al.*	Design intuition is holistic, fast, multisensorial and experience-based, and able to access unconscious processes, emotions and creativity (Badke-Schaub & Eris, 2014).	Industrial design

Table 5 contains information relating to the way in which the educational design was conceived: its objectives, planning structure and key results achieved or imagined (if ED was only designed and not implemented) (Table 5).

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Table 5 - Characteristics of the Designed and/or Implemented ED

Author	ED Objectives	ED Design	Key Findings
Zhou	To promote reflective and intuitive capacity in translation ethics according to the neurocognitive model of ethical decision-making (intuition/rationality).	Pre-instruction stage: Case study (analysis of intuitive and rational responses); Instruction stage: Activities (thematic lectures; student discussions about their professional role); Supervised sessions/interactive workshops: Targeting students' intuitive and/or rational ethical decision-making competences; Post-instruction stage: Trainee assessment, program evaluation and results reporting.	*Expected outcomes from trainee assessment*: To acquire ethical decision-making competence in translation. *Program evaluation*: To elicit all course stakeholders' feedback on the program regarding its design, delivery and effect to help course designers and instructors improve their work continuously. *Final report of the program course convenor*: A detailed formal report submitted to the school, the faculty and the university for administrative purposes.
Ji *et al.*	To develop an intuitive understanding of structural concepts and a comprehension of the creative application of structural concepts.	Five (5) phases (SEEMS): Seeking new connections; Exploring new meanings; Evolving into intuitive understanding; Making wide and creative applications; Simplicity. The following teaching methods were used: Examples, exercises and summarised case studies.	*Expected results:* Students acquire intuitive understanding of structural concepts (without the need for analysis), guiding them from structural elements to whole structures and from theory to practice.
Dart *et al.*	To examine how students engage with and perceive 3D printed models in a second-year structural engineering course. To acquire structural engineering concepts: building intuition by physically connecting theory to real life (practice).	ED delivered face to face and online. Self-directed study materials in the form of a course book; a series of 3D printed components were developed to support exploration of structural mechanics principles. *Model of learning*: Hattie & Donoghue, 2016.	Assessment consisted of three online quizzes, a class test and a final exam. Overall, students agreed that the 3D printed models improved their understanding of the subject matter and perceived this would impact positively their grades.
Kryjevskaia *et al.*	To apply the Newton's 2nd law to objects at rest through mindware (existing formal knowledge) and cognitive reflection.	Three (3) stages: Stage 1 (individual work) - after students completed pre-test: Students were given the correct answer to one of the two questions in the pre-test and were asked if they agreed with that answer and to explain their reasoning. Stage 2 (group work intervention): Each group was tasked with discussing their approaches to the questions until a group consensus was reached, at which point a single group consensus response was submitted via a web-based form for each of the two questions. Stage 3 (group work intervention consisting of a sequence of guiding questions): For students who did not answer the questions correctly in Stage 2, more scaffolding was provided and step-by-step guidance for analysing the questions.	An educational intervention based on dual-process theory demonstrated that in order to switch from a first-available, highly compelling, yet incorrect intuitive model to an alternative model based on formal knowledge (mindware), students must be able to engage in cognitive reflection so they may detect the model conflict and successfully mediate their intuitive thinking with analytical thinking that draws upon the relevant mindware.

Author	ED Objectives	ED Design	Key Findings
Cupchik *et al.*	To encourage students to reflect on the potential relations between intuitive and logical approaches to design idea generation.	One-day workshop (evidence-based approach): Design brief, creation of intuitive and logical clusters. Divided into two sessions: half of the students adopted an intuitive approach in the morning and a logical one in the afternoon to solve design briefs, whereas the reverse applied to the other half. Students always worked in small groups. Evaluation of experiences after 30 minutes and again at the end of a 2-hour design session. Design proposals assessed by experts.	Proposals by students in the intuitive condition comprised mostly images while those created in the logical condition were verbal. The logical approach lent confidence to students and was easier to adopt, but only after applying an intuitive approach in the morning session.

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3. Results

3.1. Overall characteristics of the reviewed studies

Each of the three tables presented above (Table 3, 4, 5) contains information that offers answers to some research questions of this review. The content in Table 3, for example, addresses question 2 about the reference population for which the ED has been designed and/or implemented. Table 4 reveals how intuition is conceptualized in some academic disciplines (question 1, 3). Finally, Table 5 provides answers to research questions 4, 5 and 6, concerning the educational objectives of the ED proposed and/or implemented, the kind of design adopted in the ED and the key findings achieved or intended by the ED.

Among the general characteristics that emerged from the analysis, of particular interest are those concerning the representativeness of the population, the type of research methods used by the authors of the articles and the implementation of ED. As for the recipient population of ED, this is composed of engineering students (two articles), students of a translation school (one article), physics students at university (one article) and industrial design students (one article). The majority of ED, however, has been implemented in STEM courses. In terms of research methods used by the authors to present the ED, most prevalent is the mixed-method approach (e.g. evaluation of the quality of ED implemented and evaluation of the objectives achieved by the students through a combination of qualitative and quantitative data). Another characteristic related to ED implementation is the number of students for whom it was intended. The two EDs that were only proposed do not stipulate a number of potential participants. On the contrary, the three implemented EDs report quite variable student numbers. Most impressive is student participation (n=517) in the ED discussed in the article by Mila Kryjevskaia and colleagues (2020) as the goal was to generalize the results. This is also the reason why this ED was implemented at three different universities.

The following subsections present the most recurrent and most important conceptual categories that emerged from the analysis and review of the five articles. These subsections interpret information from the same three tables discussed above.

3.2. Conceptualisation of intuition and the involved disciplines

From the analysis of the information presented in Table 4 it emerges that only authors of two articles (Dart & Lim, 2022; Ji, Bell, & Wu, 2021) developed their own concept of intuition without making any reference to any definition from the literature. For example, Ji and colleagues (2021), similar to Dart and colleague (2022), view intuition as a viaticum through which to achieve different levels of understanding. The authors do not consider, however, the role that reason plays in relation to intuition. Interestingly all authors who developed their own concept of intuition come from civil engineering. Their conceptualisation suggests that intuition in the engineering field is understood as gut feeling based on past knowledge gained over time through experience. For engineers, intuition lies at the intersection of disciplinary expertise and general experience, which aligns with the underlying sentiment that intuition alone is not enough to justify a decision (Aaron *et al.*, 2020). Some scholars believe, for example, that intuition is situated within the process of problem solving and support the complementary understanding of intuition as the synthesis of problem-solving approaches (Miskioğlu *et al.*, 2023).

From the other three reviewed articles that base their definitions on the existing literature, a consensus about intuition emerged as being pre-conscious, infused with affect, emotions and feelings, and related to creativity (Sinclair & Ashkanasy, 2005). This understanding is certainly shared by Meng Zhou (2022) who draws on the default-interventionist model, stipulating interaction between intuition and reasoning, for eliciting moral decisions in tasks relating to correct and reliable translations (discipline: Translation ethics). Intuition, in this case, is triggered by a 'circuit breaker' or a surprise.

Kryjevskaia and colleagues (2020) take a different stance and outline intuition in broader terms than mere gut feeling or the value of experience. For them, it encompasses also formal knowledge/mindware and cognitive reflection (discipline: Physics). This conceptualisation is useful when adequate experience has not yet been acquired. Mindware is usually described in the literature as a set of rules, knowl-

edge, procedures and strategies that can be recovered from memory to help the decision-making process (Stanovich, 2009).

A more multifaceted perspective is presented by Gerald Cupchik and colleagues (2024) in their ED for creative design ideation. The authors distinguish between experiential intuition (based on fast retrieval of past experience) and associative intuition (based on free associations generating new ideas). This is consistent with a common differentiation between expert intuition used in fast decision-making and a protracted emergence of creative intuition prevalent in novel problem solving (Sinclair, 2010). Drawing on dual-process theories, the authors view intuition and reasoning as complementary in their ED (discipline: Industrial design). For industrial design as well as for physics intuition plays an important educational role in the association of ideas and experiences in problem solving, but for those who have little experience it is advisable not to rely solely on it.

3.3. Educational Design and its relationship with intuition

This section interprets the relationship between the way in which the authors of the reviewed articles designed the ED and conceptualised intuition.

For the authors of the two articles that formulated their own concept (Dart & Lim, 2022; Ji, Bell, & Wu, 2021), intuition helps students create new meanings, connections, understandings, and as such, is considered a critical capacity. Interestingly, all these authors not only come from the same discipline (civil engineering) but they have also developed similar educational objectives for their ED: An intuitive understanding of structural concepts and the use of intuition to create connections between theory and practice. The authors of both articles believe that intuition through observation plays an important role in the acquisition of conceptual content. For this reason, Ji and colleagues use exercises and case studies while Dart and colleague utilise 3D printers. The premise is that intuition can be drawn either from theory or from practical experience. For example, the teaching/learning method in five SEEMS phases (Seeking new connections, Exploring new meanings, Evolving into intuitive understanding, Making wide and creative applications and Simplicity) proposed by Ji and colleagues highlights such characteristics of intuition as coherence, harmony and elegance that found support in work by some intuition scholars (Dörfler & Ackermann, 2012).

Dart and Lim (2022) have, in turn, designed an ED based on physical interaction with 3D models that allowed some students unstructured self-directed exploration, while simultaneously facilitated for other students problem-solving activities, in order to strengthen understanding. It suggests that some students used their intuition to gain understanding (deepen their knowledge) while others to solve problems (exploit their creativity). Dart and Lim refer particularly to the evidence-based learning model by John Hattie and Greg Donoghue (2016) that consists of three phases: Superficial learning, deep learning and transfer. In the surface phase, students aim to reproduce facts and processes without forming connections between ideas. In the deep phase, students have a sense of what they are learning by developing relationships between concepts, while the transfer phase involves application of learning in extensive situations. In this model, the application of knowledge content to extensive situations requires deep learning prior to the acquisition of knowledge itself. In the ED designed by Dart and Lim, the value of spatial orientation and interaction with objects reveals another layer of intuitive learning.

Zhou's ED (2022) aims instead to train both the 'deliberative (reasoning) mind' and the 'intuitive mind' through the use of thematic lectures, classroom teaching and supervised sessions, comprising guided case analysis, self-reflection, group discussion and feedback. The main ED objective is to develop moral interpretation through reasoning that would complement intuitive moral judgement shaped by ingrained values. Zhou's reference is the neurocognitive model of ethical decision-making (Reynolds, 2006) where moral decisions are based on the lower-order reflexive/intuitive cycle in the brain and the higher-order analytical/reasoning cycle. This means that when one has to make an ethical decision, the reflexive cycle automatically tries to match received moral stimuli with ethical prototypes stored in one's memory. Only when the reflexive cycle is challenged, the analytical cycle intervenes, which may also result in the restructuring of existing ethical prototypes, thus creating an opportunity for learning that may lead to an improved ethical judgement. For Zhou, ethical decision-making competence in translation is therefore a double construct that combines the experience of the translator to decide intuitively and

to reflect on the decision rationally. A collateral goal is to help students become aware of their socially conditioned moral intuitions so they can question them.

The ED by Kryjevskaia and colleagues (2020) goes even further. Its aim is not to develop intuition, but rather to correct or remove it when it causes flawed reasoning in certain less common-sense contexts, specifically in more abstract disciplines such as physics. The authors draw on dual-process theory, and like other reviewed EDs intended to develop expertise, they utilise further cognitive constructs such as mindware (previous formal knowledge) and cognitive activities such as reflection. Their goal is to help students control the validity of what is developed in the initially flawed intuitive phase. Because of their focus on expertise, the authors distinguish between intuition of experts and novices, as has been established in the intuition literature (Baylor, 2001).

A different perspective is presented by Cupchik and colleagues (2024) who focus in their ED on how to combine intuition effectively with logic/reasoned judgement. While the former draws on experience developed through practice, the latter utilises theoretical knowledge developed through formal instruction. Contrary to other reviewed articles that focused mostly on expert intuition, the authors distinguish between experiential intuition (similar to expert intuition) and associative intuition (similar to creative intuition) where the latter emerged mostly in the form of images. As a collateral, students with visualisation skills found it difficult to follow detailed instructions that, on the other hand, were preferred by students with verbal skills. Creative intuition, however, could be promoted only in the presence of sufficient basic knowledge.

Unlike Zhou (2022), the authors of the other two articles preferred to adopt a more evidence-based approach to education. The didactic method prevalent in all three articles revolves around work or discussions in a small group. The educational dimension of intuition seems to emerge through group work and a discussion among several students, as it allows for the externalisation of first ideas that come to mind (Lobato Rincón *et al.*, 2021). Small group work is a methodology used in problem-based learning (PBL) or in team-based learning (Cera, 2017) where the role of intuition is decisive. In STEM education, for example, the PBL is used to teach complex concepts of physics, as it allows, through investigation and comparison (Lee, Larkin, & Hoekstra, 2023), to externalise in the first moment creative ideas conveyed through intuition and then resort to conscious reflection when an epistemological belief may become a dangerous misconception. If intuition consists indeed of a non-sequential association of information that involves emotional and sensory elements, then the intuitive dimension of education can utilise didactic methods based on the use of images, simulations and experiences accumulated over time. This conclusion finds support in experiential learning of David Kolb (1984) and also John Dewey (1993) who refer to a dimension through which it becomes possible for intuition to assume educational value. For Kolb, learning is a process that creates knowledge through the transformation of experience. In turn, Dewey believes that learning takes place through discovery and experience as a process in which theory, observation, action and experience integrate. In summary, observation, simulation and experience help intuition create associations between information, and as a result generate new knowledge that can be later reflected upon, thus helping to feed the continuum of the conscious process.

4. Discussion

The results of this scoping review demonstrate that the educational dimension of intuition is of little importance in Higher Education. In fact, only five articles were included in the review because they clearly conceptualised intuition and then embedded it into an educational design. Reflecting on the review results, it would therefore be necessary to ask ourselves why most of the academic disciplines pay little attention to the role of intuition not only in the educational field but also in the way education prepares students for the professional world. In fact, there is no doubt about the relevance of intuition particularly in highly uncertain and ambiguous decision-making environments. This could be a valid reason to consider an educational design in which intuition plays a recognised part. Some studies (Miskioğlu *et al.*, 2023) did underline the lack of attention that the academic world has so far paid to the educational and professional role of intuition even in such fields as engineering where it is considered as something located at the 'intersection between disciplinary competence and general experience'. In the literature, those who are able to give answers through intuition are often defined as experts (Dreyfus &

Dreyfus, 1980). The engineering intuition is therefore understood as an unconscious use of experience and should be useful for evaluating a present situation or forecasting a future result. Intuition and experience therefore work in tandem, which is consistent with Baylor's (2001) conclusions about immature intuition of novices versus mature intuition of experts in her U-shaped intuition-expertise model.

Decision-making skills are necessary not only for engineers but also for leaders and managers who often find themselves faced with problems for which analytical ability is not enough. In order to be understood and correctly interpreted, complex problems require an infusion of the 'silent knowledge' accessed through intuition. Business problems are often viewed as existing in the external world and therefore in need of rational solutions. At a deeper level, however, consideration of the complex factors driving external problems reveals that many of them are motivated internally and their solution requires also the use of tacit knowledge and an acknowledgement of the interior realm of intuition (Hallo & Nguyen, 2021). In addition to the professional world of management and that of engineering, intuition plays a necessary role also in the professional sphere of teaching. There it can, for example, help teachers sense students' needs, engage with them more easily and effortlessly and prevent conflicts. Furthermore, the role played by intuition emerges as important in social work where workers are often called to make delicate decisions in which intuition and not only rational cognitive faculties help select the best way to communicate with customers and their families. This type of intuition appeals to internalised learning, tacit knowledge and that kind of expertise which is usually difficult to define.

5. Conclusion

Overall, the authors of the five reviewed articles have conceptualised intuition in a way that is consistent with the educational principles and methods in the proposed EDs. Intuition was, for example, frequently surfaced through visual means or images that circumvented verbalisation, which is consistent with its associative characteristic. Most teaching methods relied on experiential learning, reinforced through group discussions that helped surface intuitions and verbalise them, in some cases they also encouraged the development of group/shared intuition. From the interpretation it became obvious that STEM disciplines prefer active learning supported with visuals, designed to build connections or associations in order to gain deep understanding of a phenomenon; as such, they usually developed expert intuition. Instead, humanities used intuition to establish a new framework for learning; often linked to its creative aspect, which tends to be more infused with affect. All articles emphasise, explicitly or implicitly, the importance of a 'kind' learning environment where students are free to experiment without fear of failure or penalty, which is consistent with intuition research (Hogarth, 2001).

Our hope is that this scoping review will serve as a starting point for the development of ED, in which the educational dimension of intuition is highlighted. As the next step, we could draw on the contribution of different disciplines, considering the interdisciplinary nature of intuition research.

References

Aaron, C., Miskioglu, E., Martin, K. M., Shannon, B., & Carberry, A. (2020). *Nurses, managers, and engineers—Oh my! Disciplinary perceptions of intuition and its role in expertise development*. Paper presented at the IEEE Frontiers in Education Conference, Virtual Online. https://doi.org/10.1109/FIE44824.2020.9274026

Arksey, H., & O'Malley, L. (2005). Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology*, 8, 19–32. https://doi.org/10.1080/1364557032000119616

Badke-Schaub, P., & Eris, O. (2014). A theoretical approach to intuition in design: Does design methodology need to account for unconscious processes? In A. Chakrabarti, & L.T.M. Blessing (Eds.), *An Anthology of Theories and Models of Design* (pp. 353–370). London (UK): Springer.

Baylor, A. L. (2001). A U-shaped model for the development of intuition by level of expertise. *New Ideas in Psychology*, *19*(3), 237–244. https://doi.org/10.1016/S0732-118X(01)00005-8

Bruner, J. (2016). *Il processo educativo*. Roma (RM): Armando.

Bruzzone, D. (2023). Ritrovare il senso dell'educare. I fini dell'istruzione dell'era della "learnification". *Encyclopaideia*, *27*(1S), 5–8. https://doi.org/10.6092/issn.1825-8670/16680

Cera, R. (2017). Un modello di Team Based Learning per la ricerca empirica in educazione. In L. Ghirotto (Ed.), *Formare alla ricerca empirica in educazione* (pp. 223–229). Atti del Convegno Nazionale del Gruppo di Lavoro SIPED, Teorie e Metodi della Ricerca in Educazione. Dipartimento di Scienze per la Qualità della Vita, Alma Mater Studiorum – Università Bologna.

Chi, M. T. H., Glaser, R., & Farr, M. J. (Eds.) (1988). *The Nature of Expertise.* Mahwah (US): Lawrence Erlbaum Associates, Inc.

Cupchik, G. C., Van Erp, J., Cardoso, C., & Hekkert, P. P. M. (2024). The complementary roles of intuition and logic in creative design ideation. *Psychology of Aesthetics, Creativity, and the Arts*, 1–16. https://doi.org/10.1037/aca0000635

Dane, E., & Pratt, M. G. (2007). Exploring intuition and its role in managerial decision making. *The Academy of Management Review, 32*(1), 33–54. https://doi.org/10.2307/20159279

Dart, S., & Lim, J. P. B. (2022). Three-dimensional printed models for teaching and learning structural engineering concepts: Building intuition by physically connecting theory to real life. *Journal of Civil Engineering Education*, *149*(2), 1–21. https://doi.org/10.1061/(ASCE)EI.2643-9115.0000078

Descartes, R. (1637/1998). *Discorso sul metodo.* Roma-Bari: Laterza.

Dewey, J. (1993). *Esperienza e educazione*. Scandicci (FI): La Nuova Italia.

Dörfler, V., & Ackermann, F. (2012). Understanding intuition: The case for two forms of intuition. *Management Learning, 43*(5), 545–564. https://doi.org/10.1177/1350507611434686

Dreyfus, S. E., & Dreyfus, H. L. (1980). *A five-stage model of the mental activities involved in directed skill acquisition*. Berkeley (USA): University of California Operations Research Center.

Dreyfus, S. E. (2004). The five-stage model of adult skill acquisition. *Bulletin of Science, Technology and Society*, *24*(3), 177–181. https://doi.org/10.1177/0270467604264992

Epstein, S. (1994). Integration of the cognitive and the psychodynamic unconscious. *American Psychologist*, 49, 709–724. https://doi.org/10.1037/0003-066X.49.8.709

Evans, St B. T. (2010). Intuition and reasoning: A dual-process perspective. *Psychological Inquiry*, *21*(4), 313–326. https://doi.org/10.1080/1047840X.2010.521057

Fellnhofer, K., Sadler-Smith, E., & Sinclair, M. (2023). Training intuition: Challenges and opportunities. In J. Liebowitz (Ed.), *Developing the Intuitive Executive* (pp. 17–38). Boca Raton (USA): CRC Press.

Freire, P. (2022). *Pedagogia degli oppressi*. L. Bimbi & C. Alziati, transl. Torino (TO): Edizioni Gruppo Abele.

Ghirotto, L. (2020). *La systematic review nella ricerca qualitativa*. Roma (RM): Carocci.

Hattie, J. A. C., & Donoghue, G. M. (2016). Learning strategies: A synthesis and conceptual model. *npj Science of Learning*, 1, 16013, 1–13. https://doi.org/10.1038/npjscilearn.2016.13

Hallo, L., & Nguyen, T. (2021). Holistic view of intuition and analysis in leadership decision-making and problem-solving. *Administrative Sciences*, *12*(1), 1–25. https://doi.org/10.3390/admsci12010004

Hogarth, R. M. (2001). *Educating Intuition*. Chicago (USA): University Press.

Husserl, E. (1900/2015). *Ricerche logiche.* Milano: Il Saggiatore.

Ji, T., Bell, A., & Wu, Y. (2021). The philosophical basis of seeing and touching structural concepts. *European Journal of Engineering Education*, *46*(6), 889–907. https://doi.org/10.1080/03043797.2021.1936459

Kahneman, D. (2011). *Thinking, Fast and Slow*. London (UK): Penguin Books.

Kolb, D. A. (1984). *Experiential Learning Experience as the Source of Learning and Development*. Englewood Cliffs (USA): Prentice Hall.

Kryjevskaia, M., Stetzer, M. K. R, Lindsey, B. A., McInerny, A., Heron, P. R. L., & Boudreaux, A. (2020). Designing research-based instructional materials that leverage dual-process theories of reasoning: Insights from testing one specific, theory-driven intervention. *Physical Review Physics Education Research*, *16*(2), 020140, 1–21. https://doi.org/10.1103/PhysRevPhysEducRes.16.020140

Lee, M., Larkin, C. J. K., & Hoekstra, S. (2023). Impacts of problem-based instruction on students' beliefs about physics and learning physics. *Education Sciences*, *13*(3), 1–16. https://doi.org/10.3390/educsci13030321

Levac, D., Colquhoun, H., & O'Brien, K. K. (2010). Scoping studies: Advancing the methodology. *Implementation Science*, 5, 69. https://doi.org/10.1186/1748-5908-5-69

Lobato Rincón, L-L. *et al.* (2021). Multidisciplinary higher education strategies in small groups of health and social sciences. *International Journal of Higher Education*, *10*(1), 122–133. https://doi.org/10.5430/ijhe.v10n1p122

Locke, J. (1690/2006). *Saggio sull'intelligenza umana.* Roma-Bari: Laterza.

Miskioğlu, E. E. *et al.* (2023). Situating intuition in engineering practice. *The Journal of Engineering Education, 12*(2), 418–444. https://doi.org/10.1002/jee.20521

Mortari, L. Pizzato A. F., Ghirotto, L, & Silva, R. (2021). Pratiche educative per la promozione del civic engagement. *Encyclopaideia*, *25*(60), 9–24. https://doi.org/10.6092/issn.1825-8670/11558

Mortari, L., Bombieri, R., Valbusa, F., & Ubbiali, M. (2024). Il Metodo Fenomelogico Empirico (MFE) e la sua applicazione in una ricerca educativa. *Formazione & Insegnamento*, *22*(1), 8–18. https://doi.org/10.7346/-fei-XXII-01-24_02

Pestalozzi, J. H. (1928). *Ricerche sul corso della natura nello sviluppo dell'umanità*. E. Borro, transl. Lanciano (CH): G. Carabba.

Piaget, J. (1983). *Biologia e conoscenza. Saggio sui rapporti fra le regolazioni organiche e i processi cognitivi*. F. Bianchi Bandinelli, transl. Torino (TO): Einaudi.

Reynolds, S. J. (2006). A neurocognitive model of the ethical decision-making process: Implications for study and practice. *Journal of Applied Psychology*, *91*(4), 737–748. https://doi.org/10.1037/0021-9010.91.4.737

Sinclair, M. (2010). Misconceptions about intuition. *Psychological Inquiry*, *21*(4), 378–386. https://doi.org/10.1080/1047840X.2010.523874

Sinclair, M. (2011). An integrated framework of intuition. In M. Sinclair (Ed.), *Handbook of Intuition Research* (pp. 3–16). Cheltenham (UK): Edward Elgar Publishing.

Sinclair, M., & Ashkanasy, N. M. (2005). Intuition: Myth or a decision-making tool? *Management Learning*, *36*(3), 353–370. https://doi.org/10.1177/1350507605055351

Sipman, G., Thölke, J., Martens, R., & McKenney, S. (2019). The role of intuition in pedagogical tact: Educator views. *British Educational Research Journal*, *45*(6), 1186–1202. https://doi.org/10.1002/berj.3557

Spinoza B. (1677/2007). *Etica.* Milano: Bompiani.

Stanovich, K. E. (2009). *What Intelligence Tests Miss: The Psychology of Rational Thought*. New Haven (USA): Yale University Press.

Zhou, M. (2022). Educating translation ethics: A neurocognitive ethical decision-making approach. *The Interpreter and Translator Trainer*, 1–18. https://doi.org/10.1080/1750399X.2022.2030534

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