Notes from the Field
Concepts, Prototype Theory, and Inquiry

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One significant obstacle to teachers acquiring the skill of facilitating the quest for the meaning of concepts in the community of inquiry (CoI) is being trapped in the banking model of education (Freire, 1970, p.71). The conflict between P4C and the banking model of education has been extensively discussed in various contexts in Kizel (2022). Although teachers are eager to facilitate CoI in their classrooms, they also fear being unable to convey the necessary knowledge to their students in an inquiry due to the inherent involvement of conflicting views, confusion, and a lack of strict definitions about the concepts. Their criteria for success are determined by the knowledge attained at the end of the inquiry.

In this paper, I argue that the banking model of education relies on certain conceptual assumptions about the nature of concepts. I claim that for the banking model to function effectively, it must initially assume that all concepts can be defined by their necessary and jointly sufficient conditions. These conditions are believed to be collectively exhaustive and mutually exclusive. This misconception is fueled by institutional expectations, such as academic success in multiple-choice national exams, operating within this paradigm. The calculus conception of language feeds the idea of the banking model, creating an environment of fear regarding the transmission of knowledge, leading to a lack of responsibility for teaching, learning, and thinking. Students and teachers defer the responsibility for thinking about the content of definitions to an unknown authority on definitions.

In the second part, I argue that treating concepts as prototypes is helpful in demonstrating the necessity of collective inquiry, even for technical and scientific concepts that are strictly defined. Including concept activities on strictly defined technical concepts helps convince not only students but also teachers that inquiry is not a peripheral activity in philosophy but is central and essential in education. I illustrate this approach to concepts through an inquiry design in a science class on the concept of "mixture."

In conclusion, I argue that the way prototype theory interprets concepts is the most useful approach to lead inquiries and transform the mindset of teachers struggling to facilitate collective inquiry.

Banking Model, Definitions and Concepts

Freire (1970) delineates the banking model of education as the relationship between a narrating teacher and receiving students, highlighting a crucial aspect of the model—the disconnection between words and the dynamism of reality (Freire, 1970, p.71). According to Freire, this model idealizes the mechanization and dehumanization of both students and subjects, relegating them to passive receivers rather than active thinking subjects. The teacher, in this model, is akin to depositing money in a bank or filling an empty container, transmitting knowledge to students as if it were a one-way transaction (Freire, 1970, p.72). The banking model negates the process of inquiry, perceiving students as empty or ignorant and positioning the teacher as the opposite—knowledgeable and authoritative (Freire, 1970, p.74).

The banking model lies in the assumption of words and definitions operating within the calculus conception. When language is conceived as a calculus, with an exact relationship between words and meanings, the banking model prevails. Concepts are considered atomistic, self-sufficient entities, and the areas they cover are collectively exhaustive and mutually exclusive. Vagueness in definitions is attributed to our inability to articulate properly, and concepts are assumed to have exact, definable meanings. This view of language leaves no room for inquiry or exploration, fostering a system where concepts are either neglected if they lack a strict calculus or are treated as if they have precise definitions. All knowledge is predefined with the complex system of rules.

Moreover, beyond the banking model of education, there is a concurrent fear of deviating from predefined educational areas. The fear stems from the belief that everything is predetermined, and any deviation is attributed to the mistake of the educator, fostering a "pedagogy of fear." This fear inhibits dealing with existential questions and hinders educational growth by making students passive and dependent on external sources (Kizel, 2015, p.214). The duty of teaching the ignorantt child becomes an excuse for the fear of taking responsibility thinking on the vague points, of getting lost, of leaving knowledge transmission incomplete. The banking model becomes preferable for teachers as it provides a sense of safety—knowledge is already there and can be transmitted without the need for taking responsibility. The responsibility of interaction in the learning process is deferred and the autonomy of thinking is suspended. Teachers often feel more comfortable with detailed lesson plans where steps are predetermined, ensuring a smooth flow.

In the context of education and Philosophy for Children (P4C), the banking model stands in stark contrast. P4C invites children to inquire about the meaning of words, positioning them as active agents in knowledge production while teachers facilitate the inquiry process within the classroom. To dissolve the image of the banking model and free teachers from its constraints, one strategy involves focusing on concepts that do not conform to this model. Additionally, challenging the model by demonstrating its shortcomings with concepts that are presumed to work well can be effective. I believe treating concepts as prototypes can help to liberate both teachers and students from banking model.

Concepts as Prototypes

An alternative conceptualization of concepts is found in prototype theory. In this section, I will demonstrate that viewing concepts as prototypes can be advantageous for designing inquiry-based conceptual activities in the classroom. I argue that altering our conception of concepts in the curriculum, perceiving them as prototypes allows inquiry-based philosophical dialogue to present an alternative paradigm that challenges the fundamental assumptions of the banking model. I will draw upon ideas from Hampton (2006) and Ramsey (1992) regarding prototype theory, its implications on learning, and conceptual analysis. My intention is not to argue for the truth of prototype theory. However, I will contend that accepting the truth of prototype theory is inevitable from an educational standpoint.

In the classical view, we can assert that being an instance of a concept is determined by its fitness to the definition of necessary and sufficient conditions. As I have argued, the completeness of the definition is a condition for its confident transmission from teacher to student in the banking model. In contrast to this view, in prototype theory, category membership is not determined by explicit rules, that form the necessary and sufficient conditions but by the similarity of the instances to the best examples or the prototypical features of a concept (Hampton, 2006, p. 80).

Prototypes consist of features that are most common, distinctive, and salient features. Hampton states that prototypes are "abstract, generic concept that was constituted from the different ways in which the category members resembled each other and differed from non-members" (Hampton, 2006, p.80). If we conceive of a concept as an area covering its instances, then its center will be its typical instances that fit prototypical features. When an instance resembles the prototype features more, it becomes the typical instance of the concept; if it is further away from the prototype features, then there will be borderline cases subject to vagueness and disagreement (Hampton, 2006, p. 90). The distance to the prototypes is continuous, thus there is no discreteness between the concepts. There is no clear rule or system of rules that differentiates the instance from non-instance. Instead, there are patterns of similarities defining the region of the extension of the concept, supporting the idea that categorization is similarity-based and probabilistic (Hampton, 2006, p. 94). The degree of resemblance determines membership in the category, but this degree of resemblance is context-relative. The salience of a given feature for categorization judgments can vary in different contexts, for example Hampton states that "on one occasion, a person feels that being sweet is the most important feature of a typical fruit, whereas on other occasions, they feel that being round is more important" (Hampton, 2006, p.97). Consequently, there are always borderline cases. The vagueness of the borderline cases is not due to a lack of knowledge of the speakers of the language, but the prototypes' sensitivity to different measures.

Hampton (2006) outlines four key aspects concerning the conceptual understanding of speakers in prototype theory. These points can be valuable for educators in crafting inquiries. Firstly, vagueness is identified as a semantic characteristic rather than a deficiency in the speakers' knowledge. Secondly, within a given category, both typical and atypical examples exist. Thirdly, individuals can articulate the meaning of a concept that is applicable to the concept in general, even if it does not hold true for all members. Lastly, individuals often struggle to articulate an explicit rule for category membership, rendering categorization opaque to the speaker (Hampton, 2006, p.83).

If these aspects hold true, then the transmission of universal definitions to speakers becomes an impractical task. A typical definition excludes all non-instances and includes all instances of the concept; it cannot tolerate counterexamples (Ramsey, 1992, p.60). However, in the realm of prototype theory, counterexamples are always conceivable due to the inherent vagueness, and concepts are not discrete from one another.

The understanding of concepts in prototype theory bears relevance to P4C in three distinct ways. First, in education how pupils engage with conceptual knowledge matters. Thus, we have to take into consideration of the prototype and typicality effects in categorization, and treat concepts as prototypes in education. Accepting the prototype theory helps us to build better strategies for inquiry based learning, and avoid the misconceptions about banking model. Moreover, the cognitive effects of prototypes does not prevent us to suggest and discuss classically formed strict definitions of the concepts.

Secondly, typically in a P4C activity, we focus on conceptual questions. We try to produce general descriptions, essential properties, constitutive conditions, and rules for the use of the concepts. We look for the instances of the concept and try to articulate criteria that make them common. However, as Ramsey states, if what the psychologists are saying is true, then "the search for crisp definitions of various abstract notions by probing our intuitions is a seriously misguided endeavor" (Ramsey, 1992, p. 59). The competence and understanding of the concept are not governed by a system of rules or definitions but by the prototypical features of the instances. Good judgment and reasoning are related to the grasp the prototypical and salient features, and sensitivity to different contexts of the use of the concept. Then, the purpose of conceptual learning can be seen as skill acquisition, evaluating general descriptions of the concepts, gaining context sensitivity, understanding borderline cases, differentiating ordinary and technical uses to a certain extent, and adapting the scientific descriptions to our understanding of the concept. All these abilities do not make us grasp a simple general definition of the concept but a holistic picture of the concept in question. Philosophical inquiry is a fruitful space for the exercise of these cognitive abilities and skills, in the strengthening of a variety of cognitive competencies (reflection, reasoning, conceptualization, categorization, looking for clarity) that are indispensable to all inquiry. Facilitators can then design inquiries by taking prototypes, salient features, and different contexts into consideration. This idea is also in accord with Lipman's notion that teachers' main task is to work 'how best to prepare students to make judgments' (Lipman, 2003, p. 293).

Thirdly, almost any concept can be the subject of inquiry. In their P4C handbook, SAPERE suggests focusing on 'philosophical concepts' that are contestable, central, and common for classroom inquiry. However, prototype theory suggests that vagueness, opacity, and generality are present for the concepts that can be regarded as non-contestable and non-philosophical in the classical view. Then, even technically defined concepts are given attention in philosophical inquiry. If we are after a concept-centered inquiry-based learning environment, then any prototype concept can be our concern. In the next part, I will exemplify how these three points can affect our design and focus of the concept activities with an example.

Designing Concept Activity for "Strictly Defined" Concepts

It can be argued that strictly defined concepts need not be taught in an inquiry-based environment, as such definitions are often not contestable. However, if the prototype theory is correct, our cognitive abilities tend to store these terms with their relation to prototype features and typical examples. Hampton illustrates this with the example of birds. Having wings and flying do not differentiate birds from flies, but they are prototypical features. On the other hand, having feathers differentiates them from other species, but feathers are not their prototype features (Hampton, 2006, p.100). The common conflict lies between technical (natural kind terms, defined by science or scientists) and the salient features of typical examples. These conflicts drive our conceptual activity design.

In addition to SAPERE's suggestion of inquiring on common, central, and contestable concepts, we can include concepts that create confusion. If a concept is confusing, either due to differences between ordinary and scientific use or because it is a prototype concept and vague, it necessitates collective inquiry. Many non-contestable technical terms exist in the curriculum. In science, terms like star, mixture, planet, energy, mass, and life are all non-contestable technically defined concepts. However, these terms also equivocate with different uses in their ordinary use and folk conception. Furthermore, technical or ordinary concepts create intuitive descriptions, which may lead to confusion. Even non-contestable technical terms can cause confusion in our pre-reflective state. This territory of potential confusions becomes the playground for a community of inquiry.

To exemplify, let's consider a concept activity on the scientific concept "mixture." In a traditional lecture design, the concept of mixture can be introduced with definitions and examples. The teacher can ask for examples of mixtures in the students' lives, introduce common properties, and then present atypical examples like milk and honey. They can also introduce the concept of pure substances, describe their properties, and conduct experiments or observe experiments for a better understanding of the concept, and adapt the scientific description to their understanding.

Alternatively, despite being a strictly defined technical term, there is a conflict between the ordinary use and scientific use of the concept of mixture. In ordinary use, when "two things come together, a mixture happens." However, this general description can be confusing for things that are already composed of different substances before being mixed, such as a lemon before becoming a lemonade. Moreover, in chemical compounds like water, where hydrogen and oxygen molecules come together to form water, water is not considered a mixture.

To inquire about the concept of mixture, nine items are presented to students with a collective task of categorization mixture and non-mixture items. These items are selected from prototypical features, non-typical instances, and non-instances. Air and detergent are used as typical examples of mixtures, vinegar, lemon juice, honey, and milk are used as confusing examples of mixtures, and iron dust, alcohol, and ice water are used as non-mixture pure substances.

Items of Concept Activity for the Concept of "Mixture"

- Air: Despite appearing as a single entity, pupils are usually aware that air consists of CO_2 and O_2. Hence, they recognize it as a mixture, although it looks like a single substance.

- Detergent: A typical instance of solid mixtures. Its connection to supermarket products, such as honey and milk, allows kids to associate it with ingredients in familiar contexts.

- Vinegar and Lemon Juice: These examples may be confusing for pupils since typical mixtures like salad and lemonade involve these items. While lemon is mixed in salad and lemonade, by itself, it doesn't seem to be a mixture. Confusion is expected to arise from prototype effects.

- Honey and Milk: Similar to vinegar and lemon juice, but kids are also familiar with the packaging of these products. Awareness of ingredient descriptions or different milk percentages on packages prompts a reconsideration of the definition of "coming together of at least two different substances." Their idea of substance in the definition is not pure, and naming a substance with one word doesn't imply it's not produced through the mixture of many substances.

- Iron Dust: A typical non-instance of a mixture.

- Alcohol: Initially thought of as a mixture by kids since popular Turkish spirit, Raki, when mixed with water, changes its color and is also referred to as a mixture. The percentages of alcohol in spirits are often written on bottles. Moreover, alcohol can serve as an umbrella term in Turkish for spirits, leading to potential confusion about whether alcohol is a mixture.

- Water and Ice: Again, a typical example of a pure substance. While having two phisical states of a substance makes it appear as two different things, they are made of the same matter, H_2O. Given that H_2O is a well-known chemical substance, students perceive a togetherness of the two things, H_2 and O_2. This prompts them to question whether H_2O is a mixture.

The task of categorization involves building conceptual connections between various scientific concepts, including matter, substance, element, molecule, compound, and more. While focusing on a single definition can be more efficient, the comprehension of a mixture is intricately linked to a web of concepts. Our understanding of concepts is enriched through their relationships with similar concepts. For instance, the statement "a mixture is a substance that is not pure matter" is a logical connection between two concepts. These connections extend across different scientific concepts, such as compounds, elements, molecules, mixtures, homogeneity, heterogeneity, chemical reactions, and so forth. All these conceptual relations evolve through an inquiry process aimed at clarifying the distinctions between the folk conception and the scientific understanding of mixtures.

The teacher may introduce the technical definition during the inquiry, referring to the textbook. However, it's crucial to note that the driving force behind constructing this web of concepts and introduction of the textbook definition is not solely the teacher's narration. Leveraging confusion, or potential confusions, allows us to unravel tangled relationships and build complex ones. The utilization of the definition becomes a response to the conceptual confusions that arise through the inquiry process.

Facilitators can intervene with reflective questions such as "Where were we misled?," "How does our conception of mixture differ from the textbook?," "Do you find the definition satisfactory and useful?," "What are your thoughts on pure substances?," and "Are compounds considered mixtures? Why or why not?" This series of questions becomes the foundation for subsequent classes. Even if some basic assumptions are narrated, the narration serves the purpose of understanding questions that emerged through inquiry. The entire learning process unfolds within the framework of inquiry.

Conclusions

If prototype theory accurately reflects the cognitive processes of categorization and conceptual knowledge, then there are no inherently philosophical and non-philosophical concepts. Any concept can potentially undergo contestable and confusing cognitive processes that are worth exploring. Consequently, philosophical inquiry is central to any educational setting for conceptual knowledge.

References

Freire, P. (2011). The Banking Concept of Education. In *Thinking about Schools*. Routledge.

Freire, P. (2000). *Pedagogy of the oppressed* (Repr). Bloomsbury.

Hampton, J. A. (2006). Concepts as Prototypes. In *Psychology of Learning and Motivation* (Vol. 46, pp. 79–113). Elsevier.

Kizel, A. (2015). *In: Yesiayahu Tadmor and Amir Frayman (eds.) Education – Men's Questions. Tel Aviv: Mofet, pp. 214 - 223 (Hebrew).*

Kizel, A. (2022). *Philosophy with Children and Teacher Education: Global Perspectives on Critical, Creative and Caring Thinking* (1st ed.). Routledge.

Lipman, M. (2003). *Thinking in education*. Cambridge university press.

Ramsey, W. (1992). Prototypes and conceptual analysis. *Topoi*, *11*(1), 59–70.

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