Senior Honors Thesis

The Socratic Method as an Approach to Learning and Its Benefits

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Abstract

The Socratic Learning Method (SLM) is a constructivist learning approach consisting of four key steps: eliciting relevant preconceptions, clarifying preconceptions, testing one’s own hypotheses or encountered propositions, and deciding whether to accept the hypotheses or propositions. The Socratic Learning Method is particularly useful when one has to evaluate a proposition contradictory to one originally held belief, or when one has to generate and evaluate one’s own hypothesis in the face of new information. Connecting the steps of the Socratic Learning Method and studies in cognitive science, developmental psychology, and education, this thesis argues that the Socratic Learning Method enhances students’ learning as it reduces the impact of misconception, aids students in organizing knowledge, cultivates higher order thinking skills, and helps students to monitor their own learning. While the Socratic Learning Method functions as a teaching method when teachers first introduce it to students in the classroom, the thesis emphasizes its use as an approach to learning that individuals must cultivate, with practice, into a vigorous thinking habit.
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Introduction

This thesis is an effort to connect philosophy to education. This thesis focuses on the Socratic Learning Method, a teaching and learning approach extrapolated from Socrates’ conversations with his interlocutors in Plato’s works. By explaining and relating the method to studies in cognitive science, developmental psychology, and education, I hope to promote an active, inquiry-based, style of learning. Most importantly, by connecting a classical learning method to contemporary scientific researches, I also endeavor to show how philosophy, ancient wisdom, provides great insight into issues in the modern world.

The Socratic Learning Method and the Inquiry-Based Learning Method

Since the Socratic dialogues are among the earliest documented instances of learning through inquiry, it is reasonable to argue that what is now known as inquiry-based learning can trace its origin to the Socratic Learning Method. This thesis, however, does not use the two terms interchangeably: there are no clear rules of how to conduct inquiry-based learning or guidelines to what kind of questions can be asked in the process; the Socratic Learning Method, on the other hand, is more systematic and has four defined component steps that naturally lead to certain types of questions. As a result, this thesis identifies the Socratic Learning Method as a branch of inquiry-based learning, whereas inquiry-based learning is identified as one of the constructivist education approaches.
Overview of Sections

The thesis begins with a brief survey on a long standing debate in education: the Constructivist vs. Instructionist (Direct Instruction) Debate, and proceeds to explain how the Socratic Learning Method fits into the picture —by identifying it as a constructivist learning approach.

Sections 2 to 4 discuss the Socratic Learning Method’s developmental benefits. Section 2 explains the role of preconceptions in learning, how inaccurate or incomplete conceptions (misconceptions) can hinder the learning process, and how the Socratic Learning Method can minimize the impact of misconceptions. Section 3 reviews the architecture of human knowledge organization and argues that the Socratic Learning Method contributes to more effective knowledge organization. Section 4 looks at a famous pedagogical study of Reciprocal Learning that demonstrates the importance of metacognition, or self-monitoring, in the learning process. Drawing the parallels between the Socratic Learning Method and Reciprocal Learning, Section 4 argues that the Socratic Learning Method fosters the use of metacognition
and leads to successful learning as well. The last section advocates for using the Socratic Learning Method in the classroom and suggests ways that teachers can instill a Socratic learning habit in students. The section acknowledges that even though the Socratic Learning Method is a “learning method,” it must first be taught before students can internalize it and apply it on their own. Beyond practicing the steps of the Socratic Learning Method in the classroom, teachers can also expand its use through designing different kinds of homework, assessment, and activities for the students.

The ultimate belief underlying this thesis is that by instilling a Socratic Learning “style” in students—by helping them make it a mental habit, students will become more independent and autonomous thinkers. Autonomy and the ability to make rational judgment are essential to building a democratic society. By transforming students into active, Socratic learners, we are sowing the seeds for a vital democracy.
Section 1: Introduction to Constructivism and the Socratic Learning Method

1.1 A Continuous Debate in Education: The Constructivist vs. Instructionist Approach to Learning

Philosophers, educators, and research scientists never cease to propose different theories regarding the nature of knowledge and the process of learning. Through centuries and decades, various perspectives on the nature of knowledge, its acquisition and organization, or how students should be taught continue to compete against each other. For example, while some educators believe that students learn best when exploring a topic on their own, others argue that teachers should provide clear and direct instruction to pre-empt misunderstanding.

This continuous wrestling of opinion among scholars and researchers has gradually formalized into a debate in education. The debate involves two rival pedagogical approaches—each with a distinct underlying philosophy concerning the nature of knowledge and human—Constructivism vs. Instructionism.

1.2 The Philosophical Assumptions Underlying the Two Approaches

The instructionist approach is the conventional model of teaching that is still widely practiced today. As its name suggests, the instructionist approach favors giving direct and explicit instructions to students rather than having students explore on their own. Its underlying philosophy reflects John Locke’s idea of Tabula Rasa, the view that the human mind is born into this world as a blank slate void of innate ideas and only gains knowledge through senses and

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experiences.² Driven by this view, the main responsibility of educators is to fill the students’ minds with knowledge and information under the instructionist approach.

Contrarily, the constructivists doubt that human minds start out as blank slates and argue that learning requires the integration of new information with old beliefs. Constructivists believe that learners “come into formal education with a range of prior knowledge, skills, beliefs, and concepts that significantly influence what they notice about the environment and how they organize and interpret it... [For learners] new knowledge must be constructed from existing knowledge”.³ Because of this belief, the constructivists maintain that teachers need to do more than provide direct instructions and new information to the students. Instead, teachers need to pay attention to and resolve the misconceptions of the students in order to facilitate the learning process.

1.3 Cognitive Researches Show Support for Constructivism

In recent decades, the constructivist approach has garnered significant support from researches in cognitive science. Many major research breakthroughs supporting this view come from studies on infants. Many studies have indicated that infants pay more attention to certain kinds of information: language, number, physical properties, and the movement of animate and inanimate objects.⁴ For example, one study has shown that infants are aware that inanimate


objects do not move on their own and they need to be moved by other objects or forces.  

Another study has shown that when infants are given picture slides with different number of objects on them, infants look longer at a slide with different number of objects from the previous slide.  

These study results suggest that infants have innate preferences for certain kinds of information in infants. As humans are actively absorbing information starting in infancy, it calls doubts to the view that students come into classrooms as blank slates.

1.4 Instructionist’ Argument Against Constructivist Learning Approach

Although cognitive science studies have added much weight to constructivism, proponents of direct instruction are also conducting studies to support their campaign and voicing their concerns against the constructivist approach.

Along with the accumulation of knowledge, instructivists view learning as a change in the long-term memory. The instructionists purport that because constructivist learning approaches require the learner to search for information they have on a subject matter (preconceptions), such search places heavy demand on the learner’s working memory. As the working memory is

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searching for relevant prior knowledge or solution to a problem, it will not be for learning and information storage.  

Additionally, other instructionist studies have shown that “free exploration of a highly complex environment may generate a heavy working memory load that is detrimental to learning... particularly in the case of novice learners, who lack proper schemas to integrate the new information with their prior knowledge”. Therefore, the instructionists argue that the constructivist approaches are not most conducive to learning in the sense of changing one’s long-term memory.

1.5 Reconciling the Debate: Different Approaches for Different Learners

Despite the ongoing Constructivism vs. Instructionism Debate and contending research results, there need not be a definite judgment as to which approach is the best for all learners. I believe, this debate can be reconciled if scholars can identify which approach is more suitable for a specific type of learner, or what developmental stage the learner is at.

Indeed, it seems to me that the instructionist approach could benefit students who need to learn about a specific domain from scratch. People often have prior knowledge or assumption about a general field. It is much harder to have preconceptions about a field, however, when one goes into the specifics of it. For example, while I may have assumptions about basic principles of biology, I have completely no preconceptions about principles of molecular biology


8 ibid
or genetics. As the constructivist approach emphasizes relating new information to old beliefs, it is legitimate to question the use of a constructivist approach in domains where students have little to no prior knowledge. Nevertheless, it can also be said that a constructivist approach can help learners transfer knowledge and concepts of one domain to another.

Furthermore, the constructivist approach seems more applicable for teaching learners with considerable background knowledge but need to correct their misconceptions to advance further learning. In other words, the instructionist approach might be more useful in preventing learners from building misconceptions when the learners come into a specific domain with no prior knowledge, and the constructivist approach would be very helpful in dealing with the misconceptions that learners have already brought into their learning.

### 1.6 The Socratic Learning Method in Plato’s Work

Illuminated by the Constructivism vs. Instructionism Debate and the differences in their underlying philosophies, we are now in a better position to explore the Socratic Learning Method. The Socratic Learning Method is a constructivist learning method with strong attention to the role of preconceptions in learning. It is useful in learning situations where one needs to evaluate a proposition contradictory to one’s preconceptions, or when one is to generate one’s own hypothesis given new information.

The Method’s form and usage have been developed by Plato. Throughout Plato’s Socratic dialogues, Socrates confronts interlocutors and reveals to them the faulted assumption underlying in their preconceptions through vigorous inquiry.
One famous example of the Socratic Learning Method occurs in Plato’s dialogue *Meno*. In *Meno*, Meno asks Socrates whether virtue is taught, acquired by practice, or present in men innately. Meno’s very question implies his preconceptions toward what virtue is and its three possible sources: teaching, practice, and nature. Seeing Meno’s preconceptions toward virtue, Socrates encourages Meno to clarify what exactly he (Meno) thinks virtue is by having him define virtue. While Meno gives examples of virtuous acts, Socrates reveals to Meno his own misconception that virtuous acts are the same as the essence of virtue itself.

Unable to reach a consensus with Socrates on the essence of virtue throughout the inquiry, Meno reflects on the process of inquiry and proposes a paradox regarding learning. Meno asks: How can you inquire into something that you do not already know, given that you will not even know what to ask about it. And if you already know something, where is the need for further inquiry? In Meno’s words

“And how will you inquire into a thing, Socrates, when you are wholly ignorant of what it is? What sort of thing among those you don’t know will you set up as the object of your inquiry? Even if you happen to bump right into it, how will you know that it is that thing that you didn’t know?” (80e-d).  

To address Meno’s paradox and describe the function of inquiry in learning, Socrates suggests seeing learning as a way of recollecting knowledge. Socrates appeals to the notion of the soul and explains that because of the immortality of the soul, the soul is well-learned and full of knowledge. Ignorance could be a result of forgetting and learning, therefore, is a way of recollecting the forgotten knowledge that the soul once had.

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Accordingly, inquiry is a tool for probing deeper into one’s hidden knowledge – it starts with the recognition that preconceptions exist and further investigates the preconceptions by demanding their clarification. As one successfully recollects one’s preconceptions, one is better equipped to evaluate one’s own preconceptions or judge a proposition in light of the given preconceptions. In this light, Socrates’ concept of the soul’s knowledge is similar to our own prior knowledge. While Meno sees inquiry as an act directed to what is external to us – namely, new knowledge or information - Socrates sees the inquiry as a tool for introspection and a way to examine our internal ideas and preconceptions.

By Socrates’ idea of recollection and emphasis on inquiry, learning demands both reflection on preconceptions and integration of preconceptions with new information.

1.7 The Four Steps of the Socratic Learning Method

Due to the need for examining preconceptions and integrating new information in learning, the Socratic Learning Method is particularly useful in situations where one is confronted by a proposition contrary to one’s preconceptions, or when one needs to generate a hypothesis given new information. As extrapolated from the format of Platonic dialogues, the Socratic Learning Method can be broken down into four main steps: elicit, clarify, test, and decide.

To apply the Socratic Learning Method, the learners will either first embark on an inquiry or is confronted by a proposition contradictory to their preconceptions. Given that learners bring in their preconceptions as they interpret new information, questions are asked to elicit their preconceptions. As the learners become aware of their preconceptions, clarifying questions can be asked so as to reveal to learners what their preconceptions entail. After fully eliciting and
clarifying learners’ preconceptions, learners will construct hypotheses or propositions based on their preconceptions. These hypotheses or propositions will then be tested by further fact-check, critical questions, counter-arguments, counter-examples, fallacy-check, or check for contradiction, etc. Based on critical evaluation of the hypotheses, learners will then re-assess their opinions and decide whether to accept or reject their hypotheses, propositions, as well as preconceptions.

To demonstrate the use of the Method, the following is a scenario where a teacher confronts a common misconception that humans evolved from monkeys. In a lesson on evolution, the biology teacher asks the students to explain the similarities between humans and monkeys. A student suggests that the two are similar because humans evolved from monkey. The teacher’s question has thus elicited the students’ misconception. Now the teacher can clarify the student’s preconceptions by asking what he meant by the claim that humans evolved from monkeys. The student then answers he meant that monkeys are the ancestors of humans. Now that the student’s preconception is elicited and clarified, the student can reformulate his preconception into a proposition: humans and monkeys share biological similarities because humans evolved directly from monkeys; monkeys are the ancestors of humans.

Next, the teacher will test this proposition by asking critical questions such as “Does ‘monkeys evolved into humans’ imply that monkeys haven’t evolved since homo-sapiens diverged, where humans have? Why would one branch of the evolutionary tree evolve, not another?”, “Some biologists support the view that birds evolved from dinosaurs –this is still under debate but hypothetically, if dinosaurs were birds’ ancestors- why aren’t these two species similar then?”,
or “What are the other factors that can explain the similarities between monkeys and humans besides the possibility that humans evolved directly from monkeys?” Through testing the student’s hypothesis, the student will have to modify his claim as his misconception becomes more evident.

Ideally, the student will eventually reformulate his hypothesis as that humans and monkeys shared common ancestors at some point. Once the student can formulate a proposition that can withstand the test of counter arguments, fallacies, contradictions, etc., the student can decide whether he is willing to accept the proposition for now. Nevertheless, it is important for the student to keep in mind that no proposition should be taken for granted or accepted permanently without further examination. While it might be reasonable for the student to accept his modified view that humans and monkeys shared common ancestors, the students is encouraged to revisit this belief in face of new information.

After all, the ultimate goal for the Socratic Learning Method is not to help students to come up with a proposition that they can rest safely with –this would merely contribute to the creation of dogmas. The true goal of the Method is to help students examine their own beliefs and new information they encounter. In frequently exercising the Socratic Learning Method, the students should become independent learners with curiosity and sensitivity toward new information, and gradually develop a mental habit of active inquiry and vigorous thinking.
Illustration: The Four Steps of the Socratic Learning Method

- **Learning Situation**: In a lesson on evolution, the biology teacher asked the students to explain the similarities between humans and monkeys.

- **Step 1: Elicit**: A student proposes that this is because humans and monkeys are evolutionarily related - humans evolved from monkeys. The student’s misconception on human revolution is elicited here.

- **Step 2: Clarify**: The teacher asks the student to clarify what he meant by "evolutionarily related" or "evolved from". The student clarifies his claim and formulates a proposition that monkeys are the ancestors of modern humans.

- **Step 3: Test**: To test the student's proposition, the teacher asks critical questions such as "Does 'monkeys evolved into humans' imply that monkeys haven’t evolved since homosapiens diverged, where humans have? Why would one branch of the evolutionary tree evolve, not another?" etc.

- **Step 4: Decide**: After testing of the proposition, the student will decide whether to accept or reject his proposition, as well as continue to modify his beliefs in the face of new information or questions.
Section 2: The Socratic Learning Method and Preconceptions

2.1 Human Mind as a Tabula Rasa

Early theories related to the philosophy of mind influenced thoughts on human learning and education heavily. As mentioned in the Introduction, an idea that contributed to the popularity of instructionism was John Locke’s Tabula Rasa. According to Locke, the mind is a blank slate void of contents “until experience in the form of sensation and reflection provide the basic materials out of which most of our complex knowledge is constructed”. While the instructionists do not agree exactly with Locke’s theory of mind, their pedagogical approach does assume that students come into the classroom as blank slates, waiting for teachers to impart knowledge upon their mind. Cognitive scientists, however, would argue against this Lockean idea and the instructionist approach to learning. Since researches have shown that humans have innate preferences for certain types of knowledge and start learning in infancy, it is disagreeable that students enter the learning process as blank slates.

2.2 The Development of Preconceptions

Using measuring methods such as “non-nutritive sucking, habituation, and visual expectation,” researchers have found that infants actively perceive stimuli from their environment, construct experience from stimuli, and form expectations for occurrences.

In 1973, Kalnins and Bruner conducted a study where they showed 5-to-12 week-old infants a silent color film and gave them a pacifier to suck. The nipple of the pacifiers was connected to

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pressure switch that controlled the projector lens. “The infants quickly learned to suck at a
given rate to bring the movie into focus, showing not only that they were capable of and
interested in learning how to control their own sensory environment, but also that they
preferred a clear image to a blurry one”. 11

Another study by Eimas and colleagues shows that when infants become habituated to a
stimulus, their responses to the stimulus decrease. Their experiment also used the method of
non-nutritive sucking. The found that every time a researcher introduces a new sound to the
infants, the infants will suck vigorously on the nipple. As the researcher repeats the sound, the
sucking rate slowly decreases until a new sound is made. This experiment demonstrates infants’
interest for new stimulus.12 More importantly, it suggests that infants are capable of
remembering which allows them to become habituated to a stimulus.

Other studies have shown that infants look longer at things that they are interested in and they
have a sense of what’s physically possible or not. For examples, an infant would look longer at
the picture of a box appearing in the mid-air without support than a picture of a box resting on
a table. Infants are aware that it is impossible for a box to float in the air without support, so
the picture appears more interesting to them and they would look longer at it. Researchers also


12 Ibid
found that infants can distinguish between pictures showing different numbers of the same items.  

These experiment results cast doubt on the assumption that learners approach new information as blank slates. Our experience of the world is always shaping expectation, this knowledge, in turns, affects the way we interpret new stimuli or information. This type of constructed knowledge, or prior knowledge, we hold is also known as preconception.

2.3 Preconceptions and Learning

While having preconceptions is inevitable, the preconceptions we hold – particularly the incomplete, inaccurate ones - can present challenges to learning. Specifically, they can hinder our learning by distorting the way we interpret new information and they are difficult to erase even in the face of new information.

According to Lovett, students’ preconceptions consist of different concepts, models, values, and perceptions. While some of their preconceptions - the correct and complete ones - can contribute to their learning, other can actually hinder learning due to their inaccuracy, incompleteness, or irrelevancy for the context.

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“Ideally, students build on a foundation of robust and accurate prior knowledge, forging links between previously acquired and new knowledge that help them to construct increasingly complex and robust knowledge structures. However, it is important to recognize that students may not make connections to relevant prior knowledge spontaneously. If they do not draw on relevant prior knowledge – in other words, if that knowledge is inactive – it may not facilitate the integration of new knowledge. Moreover, if students’ prior knowledge is insufficient for a task or learning situation, it may fail to support new knowledge, whereas if it is inappropriate for the context or inaccurate, it may actively distort or impede new learning” according to Lovett.\(^\text{16}\)

It would be easier to correct misconceptions that take the form of isolated pieces of information and the larger, conceptual misconceptions would be harder to tackle, as Lovett also points out.

### 2.4 The Resilience of Preconceptions

This leads us to the second challenge that preconceptions bring into learning: preconceptions are resilient to new information and hard to correct or erase. In “Do Naïve Theories Ever Go Away? Using Brain and Behavior to Understand Changes in Concepts,” Kevin Dunbar and his colleagues show that the resilience of preconceptions is a big challenge to educators using the common misconception of the causes of seasons on Earth.

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Many people believe that the Earth revolves around the sun in an elliptical orbit and seasons are caused by the distance between the sun and the Earth. In truth, however, the Earth’s orbit around the sun is essentially circular and there are not big differences in the Earth’s distance from the sun at different times in a year. To understand the cause of this misconception and its resilience, Dunbar conducted a study in which he had undergraduate students at Dartmouth College complete a set of multiple choice questions and describe the cause of seasons. Afterwards, Dunbar showed the students a video explaining how the tilt of the earth influences the angle at which the sun’s rays reach the Earth and cause seasons on Earth. Students were given another set of questions and a chance to modify their written response upon viewing the video. The results of the study, nevertheless, reflect that

“[Students] did not encode the relevant information that was inconsistent with their theory. The key source of the students’ difficulty is that they fail to integrate different sources of information correctly... Thus, students merely modify their old theory rather than engage in the reorganization of knowledge that is necessary for conceptual change.” 17

Additionally, using brain imaging, Dunbar also shows the difficulty for major conceptual changes to occur as we are predisposed to regard new information that conflict with our prior knowledge as errors. Because neuroscientists have identified the neural networks associated with learning (the caudate and parahippocampla gyrus) and networks commonly associated with error detection and response inhibition (anterior cingulate cortex and dorsolateral

prefrontal cortex), Dunbar hypothesizes that by observing which networks are activated when people receive information inconsistent with their beliefs, we can see how people perceive the new information. Namely, are they treating the new information as errors or are they learning the new information? The result indicates that when people are presented with information that differ from their preferred theory, the neural networks associated with error detection show a higher level of activation than those associated with learning. Dunbar’s studies thus testify to the difficulty in altering preconceptions and achieving major concept changes.18

2.5 Minimizing the Impact of Misconception

Given the impact of preconceptions on learning, effective teaching must engage students’ preconceptions to the greatest extent possible. Other reasons for engaging students’ preconceptions in education include:

“1. To aid instruction design;
2. To leverage students’ accurate knowledge - and help students to connect them with new information- to promote learning;
3. To identify and fill gaps in students’ understanding;
4. To recognize when students are, and help students avoid, applying prior knowledge inappropriately;
5. To actively work to correct misconception; and

6. To avoid making inappropriate associations in learning”.\textsuperscript{19}

As Dunbar’s study shows that pure instruction – showing students the video in attempt to correct their misconception of the cause of seasons- is largely ineffective, I now argue that the Socratic Learning Method is more suitable in minimizing the impact of students’ misconceptions and achieving the goals listed above for engaging students’ preconceptions.

The biggest advantage of the Socratic Learning Method over direct instruction is its acknowledgement of the existence of preconceptions, its ability to work from and toward one’s preconceptions, and it elicits students’ preconceptions. By means of systematic questioning, the Socratic Learning Method brings to the students’ attention the preconceptions that they have and rely on subconsciously.

2.6 How Does the Socratic Learning Method Combat Misconception?

Each step in the Socratic Learning Method can be characterized by different types of questions.

Setting out to elicit students’ preconceptions, the teacher will typically ask a question like “what do you already think at this point?” This type of questions helps to draw out students’ initial opinion, which is mostly likely a product of their preconceptions. Then the teacher can clarify students’ preconceptions by asking what they mean by the proposition they have offered. The teacher may ask questions such as “What do you mean by x? Do you really mean for x to apply in this or other cases?” This step aims to have students attend to their preconceptions by letting them verbalize and articulate their thoughts.

Next, the teacher can test students’ preconceptions by asking them how the proposition or hypothesis that they have generated using their preconceptions would account for counterarguments, counterexamples, or any new information that conflict with what they already believe. Questions that characterize this step usually start with “how” or “why”: “How does x account for y? How do you know? Why should I believe that? Can that really be true given z?” At this point, not only the students can consciously attend to their preconceptions but also notice any incommensurability between their preconceptions and the new information.

In the last step, the students will decide whether or how to modify their preconceptions given the new information. The teacher will know whether the students have integrated new information with preconceptions by inviting them to generate a new proposition or hypothesis. If the students can integrate the new information with their modified preconceptions, without ignoring and distorting the new knowledge to maintain the consistency of their preconceptions, they are likely to have achieved some changes in their conceptual framework. If the students continue to experience difficulty in integrating the new information and modifying hypothesis, they will be encouraged to repeat the steps in the Socratic Learning Method.

*Illustration: Questions for Each Step in the Socratic Learning Method*
Ideally, there should be no termination point for the use of the Socratic Learning Method. Continuously inquiry is the heart to the Socratic Learning Method and there are always new information and experiences that invite us to keep “updating” what we think about life and what we know about the world.

**Section 3: The Socratic Learning Method and Knowledge Organization**

3.1 *The Importance of Knowledge Organization*

Learning is a process with multiple steps. As we have seen in the previous chapter, students first need to overcome obstacles posed by their preconceptions in order to fully absorb new information. After they absorb the new information, there comes another task the students need to perform in order to integrate the new information into their existing repertoire of knowledge – knowledge organization. In some cases, especially when the students have major conceptual misconceptions, they have to make ever greater modification and reorganization of their knowledge system to integrate the new information. Because of the impact on students’
learning efficiency and capacity, having a well-organized knowledge structure is crucial to
learners and is the route from novice to expertise.

There are other reasons why having a well-organized body of knowledge is important. A very
good analogy has been offered by Frederick Reif where he compares a body of knowledge to a
cabinet with folders: if you have an unorganized cabinet with multiple folders, the information
in your folder will be available; however, they will not be easily accessible. This is arguably the
most important reason for having a good knowledge organization, in Reif’s own words, “poorly
organized knowledge cannot readily be remembered or used”. Additionally, as the amount of
information one needs to handle increases and one’s body of knowledge expands, knowledge
organization will have great impact in the selective knowledge retrieval – the process or
recalling a specific piece of information. Finally, for scientists, knowledge organization is pivotal
because “the central goal of science is to predict or explain a large number of observable
phenomena”. 20

3.2 Architecture of Human Knowledge Organization

Knowledge can be organized in many ways and forms but some are more effective than others
for knowledge retrieval and further knowledge elaboration. In the following, we will review
some forms of knowledge organization and explore how knowledge structure is developed and
expanded.

20 Reif, Frederick. "Organizing Knowledge – Importance of Knowledge Organization." Applying Cognitive Science to
Four major forms of knowledge organization include: nearly random organization, list, network, and hierarchy. The listing approach organizes pieces of information, or knowledge elements, in ordered sequence. It is useful for the retrieval of sequential information but inadequate for organizing interconnected concepts or ideas. In a network, knowledge elements are associated with some other knowledge elements based on their connection and relation. There are two significant limitations to this model of knowledge organization. First, selective retrieval becomes more difficult as the networks expand. Second, networks can be local and isolated, which does not guarantee the consistency of one’s entire system of knowledge.

Hierarchy is the most efficient knowledge organization of the four types. It is a special type of interconnected network. In a hierarchical knowledge structure, central concepts are connected to each other as nodes in a network. However, the central concepts also branch out in a tree-like fashion and have subordinated levels of knowledge elements. The hierarchy model is a very coherent knowledge organization model because it groups independent knowledge elements into a concept and then connects the concepts into a larger network. This model facilitates the selective retrieval of information. In a hierarchical structure, one may start the retrieval from the top of the structure, the networks of the general concepts, and locate particular subordinate knowledge elements by travelling down the hierarchy where the connection becomes more specific.21

Illustration: Different Types of Knowledge Organization

1. Nearly Random Organization

2. List

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<td>North America</td>
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<td>South America</td>
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3. Network

4. Hierarchy
3.3 Developing Knowledge Organization

There are different ways in which one’s existing body of knowledge can be modified and expanded. This process is known as knowledge elaboration. By the integration of new information, rough description can be elaborated and become more detailed and refined; vague differences can become more precise and affording finer distinctions; subsidiary information can be added to overarching concepts; the whole can be broken down to its parts;
a general concepts can be illustrated with particular instances; and subordinate knowledge elements can be derived from primary concepts.\(^2^2\)

Although knowledge elaboration usually starts from central concepts at the top of the hierarchy and progresses down to adding specific knowledge elements, the reversed bottom-top model where one groups specific knowledge elements into superordinating concepts is another way for knowledge organization.\(^2^3\)

### 3.4 Expert vs. Novice Knowledge Organization

Given the different forms of knowledge organization, now we can compare the knowledge organization of expert to that of novice. According to Lovett, “expert and novice knowledge organizations tend to differ in two key ways: the degree to which knowledge is richly versus sparsely connected, and the extent to which those connections are meaningful versus superficial”.\(^2^4\)

In other words, experts tend to organize their knowledge in a hierarchical fashion where the overarching concepts are connected to each other in networks, with individual pieces of information subordinated and organized around abstract principles. Novices, however, usually have less systematic and well-developed organization of knowledge. Their knowledge systems usually consist of separate pieces of information with some local and isolated networks.

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\(^2^3\) Ibid

3.5 Expert vs. Novice Knowledge Organization – Examples

The differences between the expert and novice knowledge organization can lead to differences in task performances. The publication by National Research Council, *How People Learn*, provides two examples on how the knowledge organization of experts allows them to identify the underlying principles in varying issues, and aid them in making assessment and evaluation.

In one example a group of physics students and a group of physics experts were asked to sort a set of physics problems. While the students sorted the problems according to the similarities in the presentation of the problems, the experts organized the problems by the theories that were applicable to the problem. Overall, the group of experts was able to sort out the problems with shorter pause time than the group of students. The shorter pause time suggested that the experts had a more interconnected knowledge organization which required shorter search time for information retrieval.²⁵

Another example related to the study of history also demonstrates the importance of developing an expert mode of knowledge organization as well as expert mode of inquiry. According to a study by Voss, a group of competent history students and a group of historians were given a history test. The test contained factual questions, interpretation of historical documents, and identification of war scenes. In answering the factual questions related to the American Revolution, many students performed better than the historians. However, the students’ scores on interpretation of historical documents and identification of war scenes

were significantly below those of the historians. The historians were able to construct elaborate alternative explanations for historical events through their interpretation of historical documents. When asked to identify a picture that was likely to represent a scene from the Battle of Lexington, the historians referred back to the provided documents. For the students, however, identifying a picture that represented a scene from the Battle of Lexington seemed more like a matter of picking out the correct answer from a set of given choices.

The performance of the historians and the students on the two later parts of the test brings up an important point regarding the organization and development of knowledge: developing an expert mode of inquiry is essential to developing an expert knowledge organization. “Although the students scored very well on facts about history, they were largely unacquainted with modes of inquiry with real historical thinking”. The modes of inquiry and knowledge organization have allowed the historians to make better assessment and evaluation of a presented problem and enabled them to fully utilize the available resources (the provided texts), whereas the students were significantly limited by the largely disordered collection of their knowledge elements.

3.6 Difficulties in Knowledge Transmission Due to Differences in Expert-Novice Knowledge Organization

Due to the differences between an expert’s and a novice’s knowledge organization, difficulties tend to arise when an expert attempts to transmit his/her knowledge to the students. Mainly, as Reif argues,

26 ibid
“We [experts] may suffer from the delusion that knowledge transmitted to another person is actually communicated to that person. But chances are the transmitter already has a well-organized framework of knowledge whereas the students haven’t. Thus instructors themselves may sometimes convey knowledge in a poorly organized form and contribute to students’ difficulties.”

Other common difficulties in conveying knowledge from an expert to a novice include:

1. Transmitter does not convey well-structured information;
2. Transmitter fails to convey some relevant information;
3. Transmitter erroneously believes that he has communicated all relevant information;
4. Receiver pays inadequate attention;
5. Receiver has no relevant preexisting knowledge structure;
6. Receiver’s knowledge structure is incompatible with the transmitted information; and
7. Receiver may misinterpret or misunderstand some of the transmitted information.

3.7 Suggestions for Better Knowledge Organization

To ease the difficulties in helping students build an expert knowledge framework, Lovett suggests that teachers can present facts to students in a way that the knowledge elements are meaningfully related to each other, as a result of which students would be able to make meaningful inferences.

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Additionally, research has also shown that “guiding students through a process of analogical reasoning helps students to see past superficial similarities to instead focus on deeper connections and relationships. Similarly, when students are presented with and analyze contrasting cases, they are better prepared to learn from a lecture or reading assignment”.

3.8 How the Socratic Learning Method Improves Knowledge Organization and Ease the Difficulty in Knowledge Transmission

Given the importance of knowledge organization, the differences between expert and novice knowledge organization, and the suggestions for helping students build deeper connection between their knowledge elements, I argue that the Socratic Learning Method can help students organize their knowledge in a more hierarchical framework similar to that of experts, and it eases the common difficulties in transmitting knowledge from an expert to a novice when it is used as a teaching method.

The first two steps in the Socratic Learning Method, eliciting and clarifying preconceptions, are geared toward establishing the hierarchy between students’ knowledge elements and overarching concepts. For example, in *Euthyphro*, Socrates first elicited Euthyphro’s preconceptions on the idea of piety by asking him for a definition of piety. As Euthyphro gave examples of pious actions and attempted to define piety, Socrates also got Euthyphro to clarify what exactly was meant by each attempted definition. Showing the pious acts that Euthyphro named were examples but not the definition of piety, Socrates helped Euthyphro establish a form of hierarchy and made distinction between elements and concepts. Namely, by eliciting

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Euthyphro’s preconceptions of pious acts, Socrates helped Euthyphro identify the individual knowledge elements that made up the concept of piety. Clarifying the distinctions between pious acts and piety, Socrates helped Euthyphro to identify piety as an overarching concept and pious acts as its elements.

By taking the next two steps in the Socratic Learning Method, testing and deciding, learners will integrate the new knowledge with their existing belief. Testing is a way for learners to make modification on existing beliefs and see whether the new information is integratable with existing beliefs. Deciding as a step presents the question of how to integrate new information with existing beliefs: to use the top-down knowledge elaboration model or the bottom-to-top elements-to-concept knowledge condensation model.

The utilization of the Socratic Learning Method will also resolve common difficulties in helping students build an expert knowledge framework. By increasing the interaction between novice and expert in the learning process, the expert will be more aware of the students’ preconceptions and the scope and limitation of their knowledge frameworks. On the other end, as learners articulate and defend their own proposition against counterarguments from experts, learners will become more aware of the distinction between their own position and the position held by others.

Finally, as many Socratic questions stress understanding the reason why – how do premises stand in relation to the conclusion- and aim to examine causes and effects, learners will be challenged to make deeper and more meaningful connections between their hypotheses and their preconceptions in Socratic learning.
Section 4: The Socratic Learning Method and High Order Thinking Skills

4.1 Teaching Higher Order Thinking Skills as a Goal of Education

Scholars, educators, researchers, and many experts involved in education advocate teaching “higher order thinking skills” as an aim of education. The term “higher order thinking skills” means different things to experts across different disciplines nonetheless. For philosophers, higher order thinking skills are associated with critical thinking and logical reasoning; for developmental psychologists, the term goes hand in hand with metacognition; for cognitive scientists, higher order thinking skills are connected to cognitive strategies and heuristics; and, for many educators, higher order thinking skills are related to studying skills and problem solving ability.31

Despite these different significations for the term, educational psychologist Lauren Resnick points out that there are some essential features of higher order thinking that can help us identify it.

These features of higher order thinking include:

“1. Higher order thinking is nonalgorithmic: the path of action is not fully specified in advance.

2. Higher order thinking tends to be complex: the total path is not “visible” (mentally speaking) from any single vantage point.

3. Higher order thinking often yields multiple solutions, each with costs and benefits, rather than unique solutions.

4. Higher order thinking involves nuanced judgment and interpretation.

5. Higher order thinking involves the application of multiple criteria, which sometimes conflict with one another.

6. Higher order thinking often involves uncertainty. Not everything that bears on the task at hand is known.


8. Higher order thinking involves imposing meaning, finding structure in apparent disorder.

9. Higher order thinking is effortful. There is considerable mental work involved in the kinds of elaborations and judgments required.  

These features point to the overlaps between scholars’ interpretations of the term across disciplinary differences. Because this thesis emphasizes the Socratic Learning Method as a learning approach that can be utilized by learners on their own, we will look into the 7th feature of higher order thinking skills—metacognition, self-monitoring of the learning process—and relate it to the Socratic Learning Method in this section.

4.2 Metacognition and Learners - What is Metacognition?

Just as “higher order thinking”, the term “metacognition” is interpreted differently by scholars from different fields. It can mean thinking about thinking, learning to think, learning to study, etc.

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learning how to learn, learning to learn, and learning about learning. The latter three interpretations, however, would be more appropriately labeled as meta-learning.  

Hoping to capture the essence of all the available interpretations of the term, we will use Deanna Kuhn’s definition of metacognition in our analysis: “cognition that reflects on, monitors, or regulates first-order cognition”. In the context of learning, metacognition thus means monitoring the ongoing thinking or learning process.

### 4.3 Metacognition and Improvement of Performance: Brown’s Case Study

To understand how metacognition enhances and improves learning performance, Brown and Palincsar conducted a study on children with reading comprehension difficulties. The study is well-regarded and commonly known as the Reciprocal Teaching study. The overall results of the study indicate that metacognitive engagement and self-awareness are essential to achieving better comprehension which is essential to learning.

Seeking to help students with reading comprehension difficulties, Brown and Palincsar developed a learning method known as Reciprocal Teaching. There are four key steps in this method: summarizing, questioning, clarifying, and predicting. These four steps are meant to achieve six important goals of reading comprehension:

1. Understanding the purpose of reading, both explicit and implicit;

2. Activating relevant background knowledge;


3. Allocating attention so that concentration can be focused on the major content at the expense of trivia;
4. Critical evaluation of content for internal consistency, and compatibility with prior knowledge and common sense;
5. Monitoring ongoing activities to see if comprehension is occurring, by engaging in such activities as periodic review and self interrogation; and
6. Drawing and testing inferences of many kinds, including interpretations, predictions, and conclusions”.

Brown and Palincsar hypothesized that the four steps in Reciprocal Teaching can foster metacognition and help students check their own understanding, monitor their own progress.

In the process of Reciprocal Teaching, the teacher will give students a reading comprehension problem and a text to read silently. The teacher will introduce the four steps of Reciprocal Teaching—summarizing, questioning, clarifying, and predicting—to the students, and describe the purpose of each step. These four steps are taught in a series of dialogues between the teacher and the students. That is, the teacher will start out by leading the dialogues and “thinking aloud”—telling students how s/he interprets and reacts to the text. Next, the teacher will start the discussion by summarizing and asking questions about the content of the text. As students answer questions, the teacher can elicit and check for students’ misunderstanding by raising further questions or rereading the text so students can construct an agreed summary of what is read so far. The teacher will also clarify unfamiliar concepts and words that had led to

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misunderstanding. Finally, the students will make predictions regarding the text – such has further plot development, relationship between characters- based on their prior knowledge, context and clues of the reading.

In the early stages of using Reciprocal Teaching in the classroom, the teacher will model how to apply these four steps and lead the discussion. The students will take greater part in leading and directing the discussion when they become more comfortable with this learning style. In repeated studies of Reciprocal Teaching, students with reading comprehension problem had shown improvement in their standardized test comprehension scores after adapting the method.

4.4 The Socratic Learning Method and Improvement in Metacognition - the Similarities between Reciprocal Teaching and the Socratic Learning Method

Because of the striking similarities between the Socratic Learning Method and Reciprocal Teaching, it is conceivable that the Socratic Learning Method can lead to improved learning outcomes just as Reciprocal Teaching can.

Both learning methods emphasize the teacher’s role as a dialogue facilitator rather than a direct instructor. In both cases the teacher starts out by “being the student” and modeling how the student approaches the material. In Reciprocal Teaching, the teacher instructs the students how to use the four strategies by first demonstrating them in person and “thinking aloud,” similarly, in the Socratic Learning Method, the teacher plays the role of questioner that students should take up after they become comfortable with the method.

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In terms of procedures, there are significant overlaps between the steps in the two methods. In the Socratic Learning Method, the students “elicit, clarify, test, and decide”; in Reciprocal Teaching, the students “summarize, question, clarify, and predict”. Both learning methods help learners confront the potential obstacles to learning. In summarizing and questioning, Reciprocal Teaching checks any misunderstandings of the text that learners have; by eliciting and clarifying, the Socratic Learning Method brings misconceptions to the learners’ conscious attention. In testing and deciding, Socratic learners produce new interpretations of information and their prior knowledge; and in Reciprocal Teaching, learners reaffirm their grasp on the text by clarifying and predicting.

Reciprocal Teaching leads students to greater mastery of reading skill through fostering comprehension monitoring activities (metacognition) as the method requires the learners to check their own understanding of the text consistently. Based on the similarity between the Socratic Learning Method and Reciprocal Teaching, there is strong reason for us to believe that the Socratic Learning Method can lead to better learning outcomes through its enhancement of metacognition.

4.4 Learning Orientation and Learning Performance

Another way the Socratic Learning Method can lead to a greater degree of metacognition results from the learning orientation induced by the Method. Past studies have shown that learners often approach learning with two different orientations: learning or performance.
For learners who are learning oriented, their chief concern is improving their ability. They believe in their own ability to learn and improve, and that effort leads to success. They prefer challenging tasks and derive satisfaction from accomplishing difficult tasks. More importantly, they utilize self-instruction when they are engaged in the task. On the other hand, learners who are performance oriented seek to prove their competence in the learning process. They believe that individual ability determines success and they are concerned with how their performance will be judged. They derive satisfaction from out-performing their peers and tend to evaluate themselves negatively when the task is challenging. Because of the difference in orientation, learning oriented learners may possess more learning strategies than performance oriented learners. This can mean that learning oriented students are more likely to engage in Socratic learning than performance oriented students.

As students engage in Socratic Learning, they will “step outside” of their ongoing thinking process from time to time and check which stage of the Socratic Learning Method they are in, or which specific strategy in the Method they are using. Self-monitoring and engaging in metacognitive activity thus become steps superimposed on the four original steps of the Socratic Learning Method. This gives students a better sense of where they are in the learning process and learning oriented students are likely to pay more attention to this than performance oriented students.

It can also be argued that by utilizing the Socratic Learning Method, students will also gradually adopt and develop a learning oriented approach to learning. Since the ultimate goal of the Method is to cultivate a vigorous mental habit of examining knowledge, those who utilize the Method will develop an understanding and appreciation that the merit of inquiry does not simply lie in the facts and figures it ascertains. Rather, they will come to see such habit of mind is an end in itself and learning for learning’s sake is indeed a challenging but also rewarding experience.
Section 5: Cultivating the Use of the Socratic Learning Method – Transforming the Learning Approach into a Vigorous Mental Habit

5.1 Cultivating Higher Order Thinking as a Goal of Education

Although few contemporary educators would argue against the importance of cultivating higher order thinking skills or critical thinking skills in students, such skills were not viewed as a necessary goal for education in earlier times. In earlier days, only the elite educational institutions placed emphasis on such skills. The public education system was more concerned with performance-oriented education and providing basic education to the entire population. Students in the mass education system were taught simple computation or other technical skills routinely to help them acquire “well-define vocational competencies”. Interpreting complex texts, constructing sound arguments, developing original solutions to problems were more of the concerns for the elite education institutions. Nevertheless, as society changes and evolves, students need more than the basic vocational competencies to adapt to an ever-changing environment and keep up with the pace of the society as citizens. As a result, cultivating thinking skills in students has gained importance in the public education system.38

5.2 Teaching Higher Order Thinking Skills such as the Socratic Learning Method in the Classroom and Its Main Challenges

Seeing that the cultivation of higher order thinking is the common goal of today’s education community and the Socratic Learning Method, it makes sense to introduce the use of the Socratic Learning Method in the classroom. After all, as much as we emphasize the Socratic Learning Method as a “learning”, it has to be taught to the students in the first place.

However, a common challenge (or misconception, indeed) to proposals of teaching higher order thinking skills is that knowledge has to be acquired before thinking skills are taught. Educators who hold such “hierarchies in education objectives” imply that the application of critical thinking or problem-solving skills must be delayed until facts are acquired.

In objection to this belief, Lauren Resnick argues that higher order thinking is required in the successful learning at all levels, not just after acquiring the facts:

“Children cannot understand what they read without making inferences and using information that goes beyond what is written in the text. They cannot become good writers without engaging in complex problem-solving-like processes. Basic mathematics will not be effectively learned if children only try to memorize rules for manipulating written numerical symbols. All of this implies that ‘basic’ and ‘higher order’ skills cannot be clearly separated”. 39

In other words, it is important that higher order thinking skills are taught alongside the curriculum contents.

Another objection to teaching higher order thinking skills targets their teachability. The question of whether higher order thinking can be taught was raised a few decades ago. According to Resnick, some elements of thinking are clearly teachable, although the disposition to engage in higher order thinking is not necessarily guaranteed by acquiring the thinking skills. This is to say, teaching higher order thinking is not impossible but encouraging students to

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utilize it is another side to the challenge. In order to cultivate students’ disposition to employ higher order thinking, Resnick makes the following suggestions:

“1. The use of higher order thinking skills must suffuse the school program from kindergarten on and in every subject matter.

2. Training in general skills must be supplemented and supported by application throughout the curriculum.

3. Various subject matters in the school program should be taught with an eye to developing the powerful thinking methods used by experts in those disciplines.

4. Students must come to think of themselves as able and obligated to engage in critical analysis and problem solving throughout schooling”.

Additionally, Resnick also argues that there are advantages to integrating instruction of higher order thinking with the school curriculum. Namely, such integration will ensure that there is some concrete subject matter to critically reason about, and “it supplies criteria from within the disciplinary traditions for what constitutes good reasoning and thinking”.

5.3 How Can a Teacher Implement the Socratic Learning Method inside and outside of the Classroom?

Given Resnicks’ support and suggestions for integrating the instruction of higher order thinking skills into the school curriculum, I propose the following ways that teachers can apply the Socratic Learning Method in the classroom.

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41 ibid
First, the teacher can devote a certain amount of time to class discussion. Before each lesson, the teacher may divide students in groups and have them discuss a set of questions related to the subject matter s/he is going to present during the lesson. A requirement is that the teacher needs to anticipate the preconceptions that students are likely to hold regarding the subject matter, and frame the questions in the way that engages the students’ preconceptions. Within each group, depending on the number of students in the group, the teacher may even assign a student as the “discussion monitor” who will be in charge of ensuring that the discussion stays on the topic.

Another similar idea to having class discussion is to initiate debate on an issue. This can be done during the lesson or as a form of extracurricular activity. By having students defend opposing views, the students can take up the roles of interlocutors in a Socratic dialogue. This allows the teacher to take a step back in students’ learning by letting students take over the exploration process, and it gives students a chance to practice hypothesis testing, identifying logical fallacies, giving counter-arguments, or looking out for contradictions.

Outside of the classroom, the teacher may also assign more open-ended, essay based homeworks to stimulate students’ thinking. For example, the teacher may give students a historical situation to analyze, such as a military move in a war, and ask students to give reasons to support their analysis. Open-ended essay questions can not only challenge students to think deeper on an issue, they can also help the teacher identify common misconceptions on a topic as writing based assignments provide great insight to students’ thinking.
Finally, these suggestions have the implication that the way of assessing students’ performance has to become more qualitative. Instead of giving a letter or number grade to students, the teacher will provide more qualitative feedback on students’ performance. Teachers will evaluate students’ process of thinking and learning rather than the students’ knowledge. Doing so will let students know more clearly how they can improve their learning. Most importantly, giving qualitative feedback implies emphasis on learning rather than performance; it is in itself a great way to promote the learning-centered rather than performance-centered orientation.

5.4 The Ultimate Aims of the Socratic Learning Method

As demonstrated through the thesis, cultivating higher order thinking skill and transforming the mental and learning habits of students are two major goals of the Socratic Learning Method. However, they are not all there is to it. I believe that the frequent application of the Socratic Learning Method will heighten students’ curiosity and passion for learning; I believe that the Method can help students become independent learners who seek to examine their beliefs in the face of new information, and, I believe that the Method can be cultivated within the students as a vigorous intellectual habit that they will constantly apply throughout their lives.

In short, as an advocate for the Socratic Learning Method, I harbor a deep desire that the Socratic Learning Method can help students becomes more autonomous learners and decision makers. Given that autonomy in decision making is critical to a democratic society, I believe that by transforming students into Socratic learners, we are sowing the seeds for a vital democracy.
Conclusion

Throughout the thesis I have discussed the likely origin, the steps, the benefits of the Socratic Learning Method, and its relevance to the Constructivist vs. Instructionist Debate in education. I have argued that the Socratic Learning Method creates great benefits; and, as a philosophy student, I hope that by casting light on this learning method, contemporary educators can seek insight from ancient philosophical tradition.

While the thesis demonstrates that the Socratic Learning Method minimizes the impacts of one’s misconceptions, helps learners build a robust knowledge organization system, and fosters metacognition, the underlying message is that these are three crucial elements to successful learning that different learning approaches should address. Thus, by placing the Method in the debate between the constructivist and instructionist learning approaches, I am hoping to let educators know that there is another great option out there, which has just been presented in the pages above.
Acknowledgement

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