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Research Statement

I am interested in finding new methods and pedagogical approaches that help understanding and delivering mathematical concepts. I see the intersecting between pedagogy and mathematics in the topic of proofs and logic in mathematics. In mathematics we start, by using the discovery method, with small observations and operations, then we look for patterns, algorithms procedures, and furthermore, we generalize by writing theorems, formulas, and conclusions. Our intuitive thinking, the need for solving real-life problems, and curiosity often push us towards research and study more about things that matter to us, especially when we see that problems need to be solved right away. This kind of thing has driven people now and back then depending on the era in which they have lived, or they live in. For example: In these days, because of Covid 19 doctors and researchers and other health care organizations, are interested and they are working on collecting data, analyzing, modeling the spread of the virus to track epidemics and make predictions about the progression. While for example, exceedingly early (3400 BC – Mesopotamia) 1 the numerical system was discovered. Everything that is measurable and plays a specific role in our lives needs to be well evaluated. For that reason, we need mathematical reasoning and calculations to draw the appropriate conclusions.

Logic and logical reasoning are present in all we do in mathematics. For some learners, it is easy to accept a new concept as they see it in a visual way, or even in a verbal way when it connects with what they previously know. That is why I am interested in researching more in this area, or better to say approaches that we use as we teach or learn mathematical concepts and facts. We start the justification of new theorems by using axioms in mathematics. And as we go along with the hierarchy of concepts and facts, we use the previous (smaller) theorems to prove the more complicated ones. However, we know that many theorems have become automatically true facts, so why not make them axioms. We know that reasoning about a given domain of mathematics question of justification is successively pushed back further until ultimately one reaches principles with no more fundamental justification. The statements at this terminal stage are elected as axioms and the subject is then organized in terms of derivability from the base of axioms.

In fact, to prove theorems we use approaches that are motivated by philosophical questions. It would be helpful to approach the search for new axioms in a scalable way. That can be described as seeking first axioms that resolve certain low-level questions and then proceeding to questions of greater complexity.

The reason why I am interested to explore more logic, and logical reasoning is because it helps in connecting more in new era learners. So, I would like to look more into Propositional Logic, logical operations, propositional forms, purse trees and operator hierarchy, truth tables, tautologies, and contradictions, propositional equivalences, propositional identities, logic in circuits and predicate logic, quantifiers, etc.

Most importantly I am interested to explore more on mathematical proofs and logical reasoning methods applied in most of the mathematics fields: Direct proofs: theorems, mathematical inductions, - Indirect proofs: contrapositive proofs, proofs by contradiction, proofs by cases, equivalence proofs, counterexamples which are used to prove the importance of the conditions in a true statement, or to prove the falsity of the statements. etc.