Mathematics was taught from 6th century BC from the Greeks, however, the topic of communicating mathematics has only been discussed from the sixteenth century. Mathematical communication is understanding how to engage with a number of audiences to learn and understand mathematics. This could be to students through engagement activities such as an interactive session, exploration of concepts through physical objects, and the standard teaching and answering questions from a textbook.

However, in modern society, many mathematical concepts may not have been interesting or easy to understand, such as algebra, trigonometry in comparison to geometry. The current curriculum within the UK is standardised to help ensure that students are able to understand the topics with ease through the meticulous planning of what needs to be included within each year group. In contrast, in the earlier times, mathematical communication was not thought of as scholars were persuaded to explore, understand and create to compete against other scholars. It would be a battle of who has new ideas and what had happened then would have brought the foundation of mathematics in todays age.

Mathematical Communication was not spread easily to teach to others as of the lack of a printer. However, in 1440, as seen in [1], this had revolutionised the opportunity to mass produce mathematical research, theorems, and teachings for others to review and understand. The majority of new scientific ideas were not shared until scholars encountered each other or through connections, hence this meant research was primarily individual and were not seen by others. However, this did not stop individuals from sharing their knowledge, which due to the invention of the printer press, this enables individuals to publish their own scientific research to permanently record it for others to see.

[1] "[Mathematics, Communication, and Community .](https://www.encyclopedia.com/science/encyclopedias-almanacs-transcripts-and-maps/mathematics-communication-and-community)" Science and Its Times: Understanding the Social Significance of Scientific Discovery. . *Encyclopedia.com.* 28 Dec. 2021 <[https://www.encyclopedia.com](https://www.encyclopedia.com/)>.

Another study was made to show the relationship of communication for students and their understanding of mathematics. As shown in [2], the author has referenced a number of resources which showed a positive correlation between the level of a students’ understanding of mathematics and communication in the form of verbal and written. To summarise, for students to understand mathematics, it is vital for them to be able to interact with the concepts so that they can piece the puzzle together. Some may describe and think of mathematics as being logical, however, it requires creativity to be able to think outside of the box and potentially discover new concepts.

A series of methods are detailed within the paper, such as the use of manipulatives – using physical materials, verbal communication and/or social interaction – where students engage with other students to deepen the understanding of mathematical concepts, written communication – enabling them to connect and create a formal understanding of the concept, and finally combining manipulative and communication to build the solid foundation of the theory. As suggested, without the combination of the two sides, it can decrease the confidence of one understanding the concept fully. Hence, the study primarily shows the importance of manipulative use and it’s benefits of utilising this to build the platform for students to continuously write about and discuss mathematics.

Throughout the study, it compares the different types of communication in mathematics, such as – student discussion, writing about mathematics, and connecting mathematical communication and manipulative use. The blend of these variations in effect allows students to improve and deepen understand. The main purpose of manipulatives was used to understand abstract concepts.

[2] Kosko, Karl & Wilkins, Jesse. (2010). Mathematical Communication and Its Relation to the Frequency of Manipulative Use. International Electronic Journal of Mathematics Education. 5. 79-90. 10.29333/iejme/251.

From the previous journal [2], the author had referenced [3], in which I have included a summary following. As mentioned, [3], the article discussed the “educational value of engaging mathematics students in a specific form of writing to learn – the keeping of a journal throughout a mathematics course.”. It details the positive benefits of keeping a journal which allows students to reflect on the mathematics taught whilst giving teachers an insight on how students feel about the mathematical concepts and the course itself.

[3] Borasi, Raffaella, and Barbara J. Rose. “Journal Writing and Mathematics Instruction.” *Educational Studies in Mathematics*, vol. 20, no. 4, 1989, pp. 347–365., https://doi.org/10.1007/bf00315606.