

# Let's Argue about STEM!

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## Introduction:

*STEM Integration in K-12 Education: Status, Prospects, and an Agenda for Research* has called for the implementation of STEM education into classrooms to help prepare students for a STEM workforce (Honey, Pearson, & Schweingruber, 2014). Within this policy document, it highlights the collaborative nature of STEM education within the classroom and discusses argumentation as practice to help foster this collaboration. Currently, argumentation has been discussed in the context of specific disciplines (Ingliš, Mejia-Ramos, & Simpson, 2007; Erduran & Jiménez-Alexandre, 2008; Mathis, Siverling, Glancy, & Moore, 2017), rather than across them. This could potentially pose an issue for the implementation of argumentation within STEM classrooms, if our current teaching practices only highlight one of the disciplines. Because of this potential issue, we are interested in the similarities and differences between discipline-specific argumentation to help gain an understanding of STEM argumentation, specifically the reasoning that would need to be utilized within the argumentation.

## Methods:

### Corpus Development:

- The SCOPUS database was used to identify articles
- Keywords pertinent to the topic of argumentation were used to identify articles
- Timeframe was limited to the past 10 years of peer-reviewed publications
- 656 publications were retrieved as a base corpus

### Analysis of the Corpus:

- The findings from the keyword searches were identified based on the search terms that were used
- The full corpus was analyzed by year to help identify trends
- There were articles that were identified in multiple searches, this led to an analysis both with and without the duplicated articles
  - 143 were duplicate articles
- Abstracts from all articles were used to represent each discipline
- Voyant Tools was used to help understand connections across the papers in regard to the topic of interest
  - Generated Word clouds
    - Removed search terms (e.g. engineering, education, argumentation)
    - Removed the terms student, students, et, and al

Discipline	Total (Duplicates)	Total (No Duplicates)
Engineering	38	12
Humanities	8	4
Mathematics	80	41
Science*	422	420
STEM	23	2
Technology	83	29

\*Science articles were used as reference to find duplicates

## Future Directions:

This preliminary analysis has illuminated the following:

- The priorities and implementation of argumentation is discussed differently in the disciplines. *Can a “persona” of argumentation be developed to enhance the development of practice?*
- Examining the duplicate articles offers unique insight into understanding STEM. There are multiple articles that include ideas from more than one discipline, yet are not considered as STEM. *Examining these articles could help develop a standard language across the disciplines.*
- Searching SCOPUS allowed for both advantages and disadvantages. We are aware of major disciplinary education journals not being included in our search. *Comparing the results from the SCOPUS search with another database like Google Scholar will be beneficial.*

## References:

- Erduran, S., & Jiménez-Alexandre, M. P. (2008). Argumentation in science education. Perspectives from classroom-Based Research. Dordrecht: Springer.
- Honey, M., Pearson, G., & Schweingruber, H. (2014). *STEM integration in K-12 education: Status, prospects, and an agenda for research* (Vol. 500). National Academies Press Washington, DC.
- Ingliš, M., Mejia-Ramos, J. P., & Simpson, A. (2007). Modelling mathematical argumentation: The importance of qualification. *Educational Studies in Mathematics*, 66(1), 3-21.
- Mathis, C. A., Siverling, E. A., Glancy, A. W., & Moore, T. J. (2017). Teachers' incorporation of argumentation to support engineering learning in STEM integration curricula. *Journal of Pre-College Engineering Education Research (J-PEER)*, 7(1), 6.
- Sinclair, S. & Rockwell, G. (2016). Voyant Tools. Web. <http://voyant-tools.org/>.

## Results:

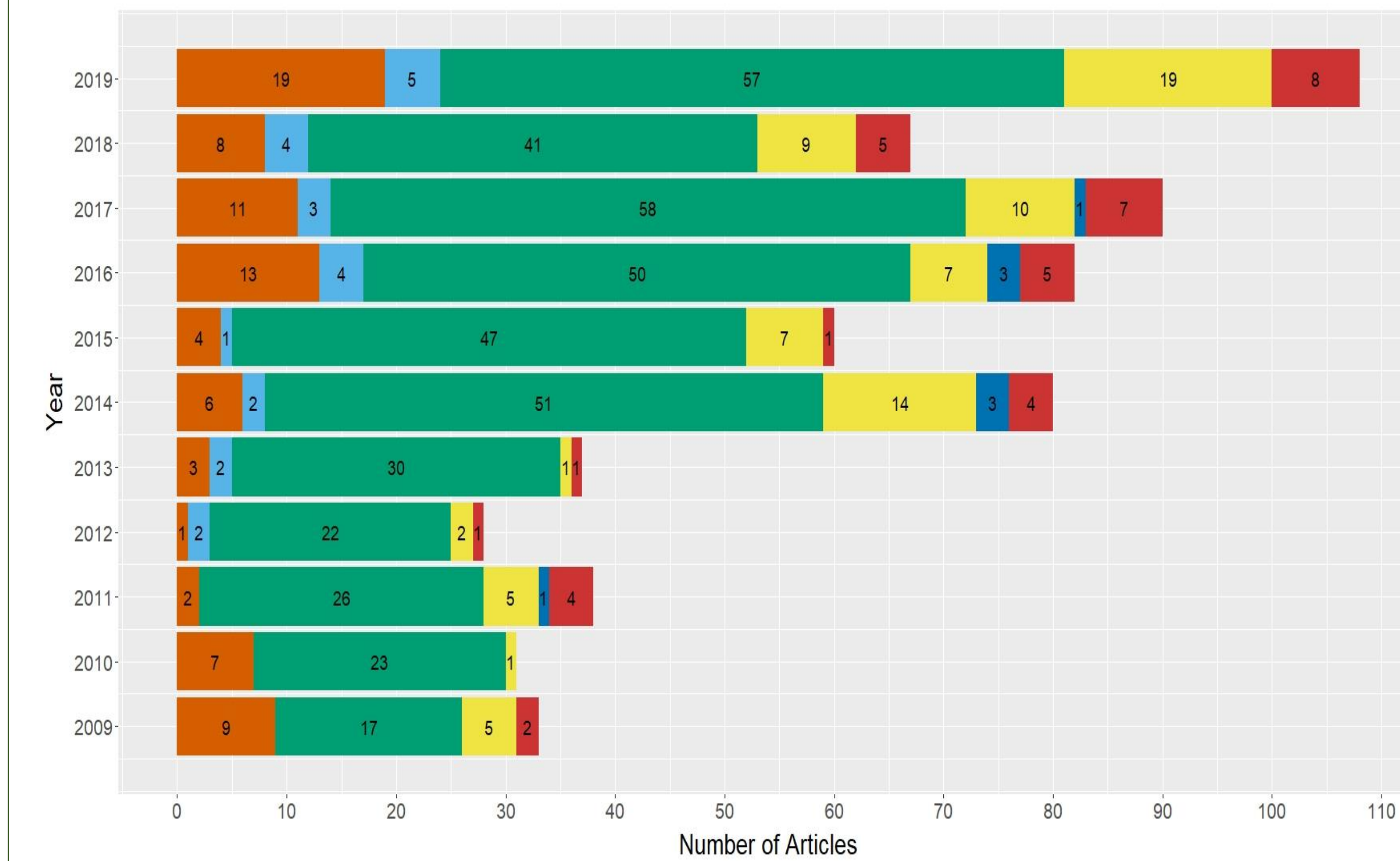


Figure 1. Counts of articles by year for each discipline when articles that appeared in multiple searches were not removed in analysis.

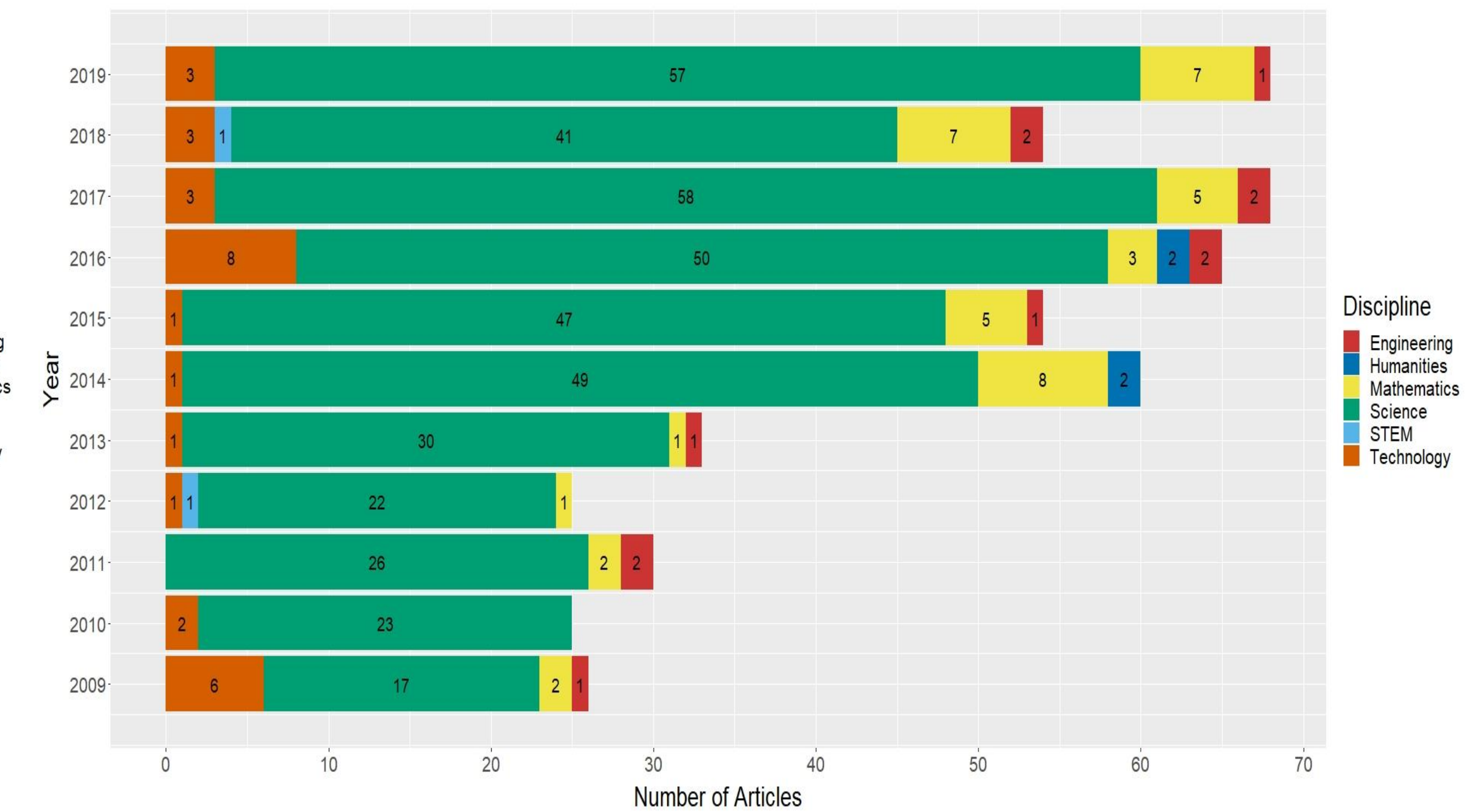


Figure 2. Counts of articles by year for each discipline when articles that appeared in multiple searches were removed in analysis.



Engineering



Humanities



Mathematics



Science



Technology



STEM