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TEACHING BIOLOGY: A REVIEW ABOUT THE CONTRIBUTION OF RESEARCH

Claudia Vergara, Beatriz Becerra, Paola Núñez, David Santibáñez, José Manuel Pavez & Hernán Cofré

INTRODUCTION

The COVID-19 pandemic has shown (Dillon & Avraamidou, 2020), many politicians, journalists, students, and biology teachers have failed to understand basic biological concepts about SARS CoV-2

Make poor decisions about their own health and well-being and that of many other people

PURPOSE:

In this review, we aim to provide an up-to-date synthesis of what we know about research in biology teaching and learning and to shed light on how to improve biology understanding among students

Research in Biology Education: development and organization

Publications about:

In Books:

- "Multiple Representations in Biological Education" edited by Treagust & Tsui (2013)
- "Fostering Understanding of Complex Systems in Biology Education" edited by Ben-Zvi Assaraf & Knippels (2022)
- Critical Thinking in Biology and Environmental Education" edited by Puig & Jiménez-Aleixandre (2022)

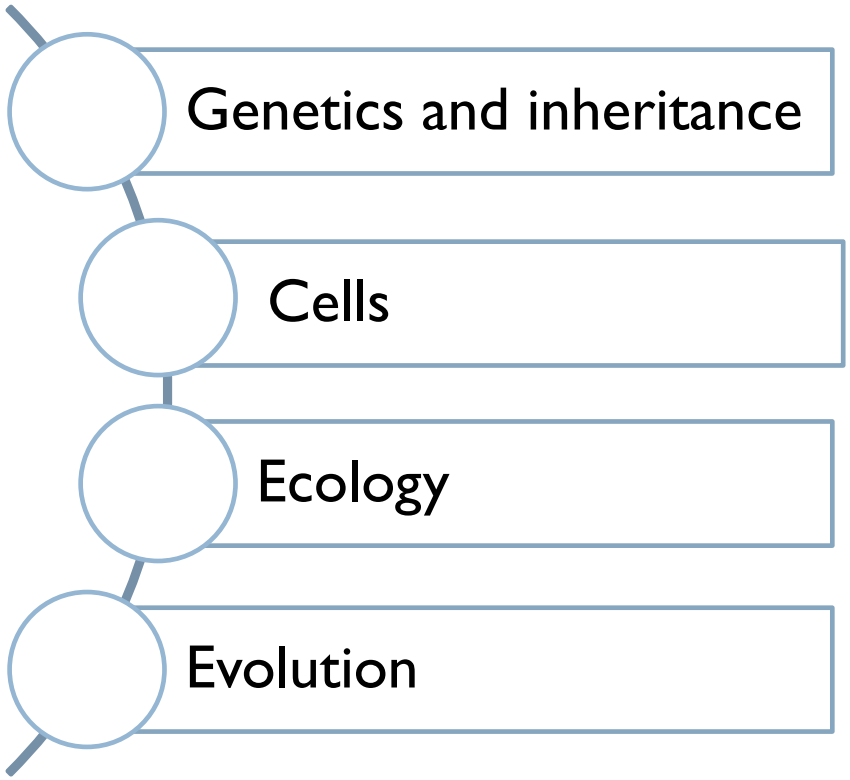
- Evolution education re-considered" edited by Harms & Reiss (2019)
- Genetics Education" edited by Haskel-Ittah & Yarden (2021)

In Reviews:

- About the teaching of genetics (Stern & Kampourakis, 2017)
- About teaching and learning evolution (Glaze & Goldston, 2015)
- About those targeting an understanding of human biology (Peart, 2022)

No single article or book chapter has systematized the research within biology teaching and learning of the last decade (but see Kampourakis & Reiss 2018; Lazarowitz, 2014).

BIOLOGY EDUCATION



Here we reviewed the research on the understanding and teaching of seven main topics of interest namely: cell biology, metabolism, human biology, genetics and inheritance, ecology, evolution and general topics

Duncan et al. (2017); Millar and Osborne (1998); Kampourakis and Reiss (2018)

Methods

7 categories

- Evolution
- Cell biology
- Metabolism including molecular biology and most of microbiology
- Ecology (including plant biology)
- Human biology (including physiology, development, reproduction and sexuality, health and disease),
- General Topics
- Genetics and inheritance and general biology (studies that include a combination of the previous categories and biotechnology)

In addition, the country where the research was conducted, the educational level of participants, and the science education topic investigated were recorded.

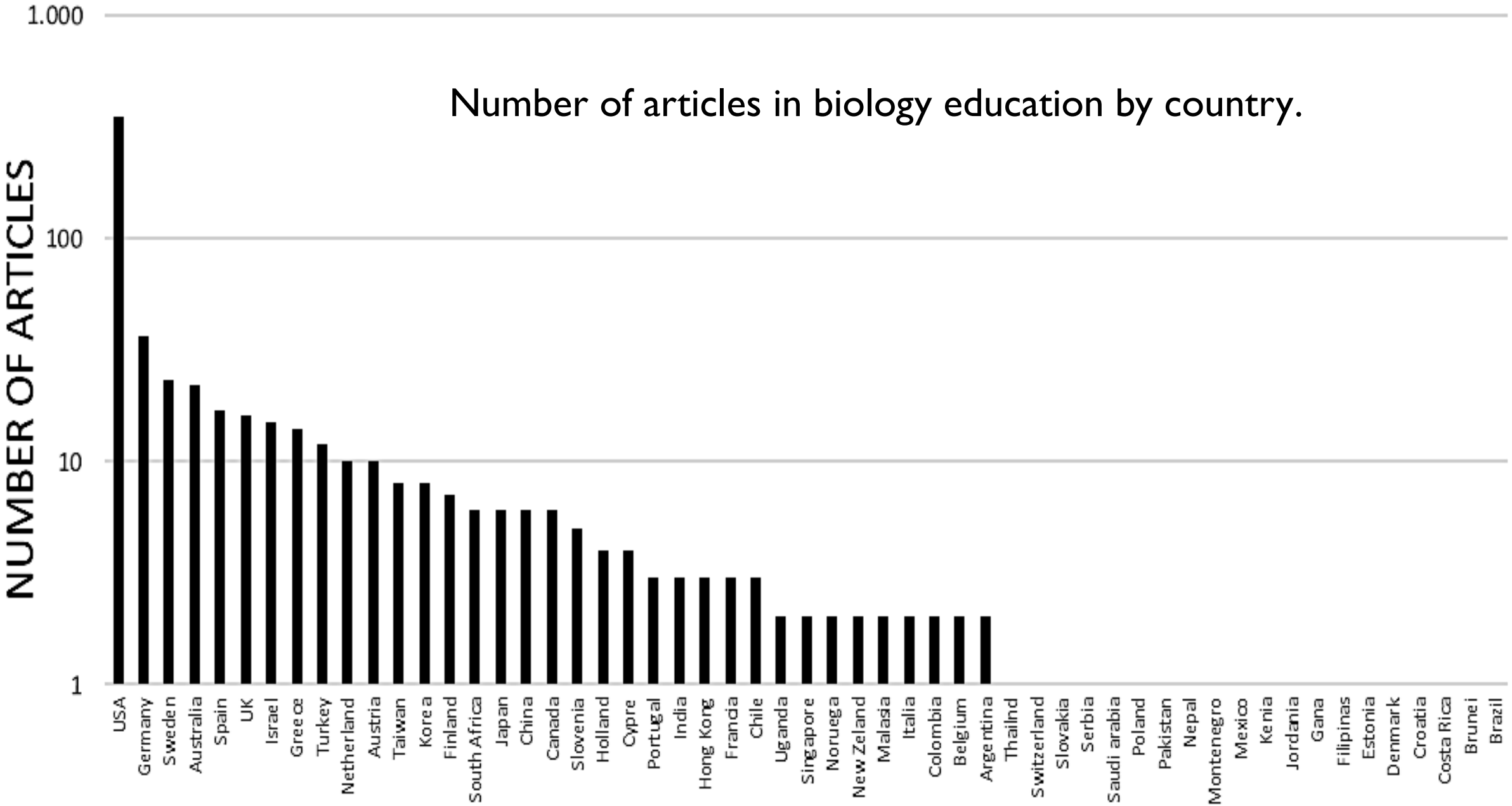
Methods

- In this study we presented an exploratory-descriptive analysis of trends in biology education research between 2010 and 2021.

- For this purpose, we analyzed articles with empirical data published in 5 international science education journals **(*Journal of Research in Science Teaching*, JRST; *Research in Science Education*, RISE; *Science Education*, SE; *International Journal of Science Education*, IJSE; and *Journal of Science Education and Technology*, JSET),** and two biology education journals **(*Journal of Biological Education*, JBE; and *CBE Life Science Education*, CBE LSE).**

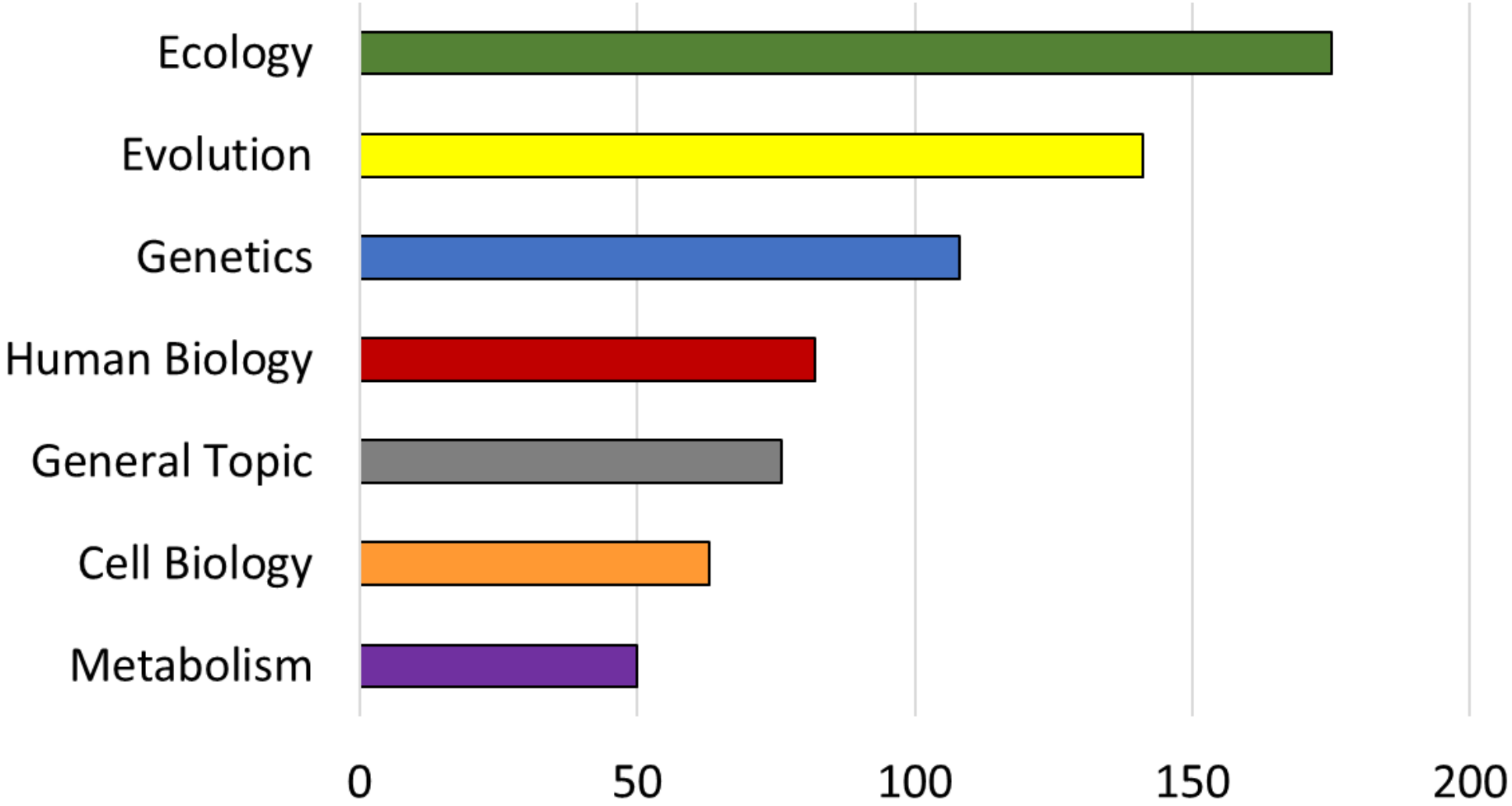
- These journals were chosen because they have the highest impact indexes within the area of science education (the first 5) or biology education (the last two).

Results

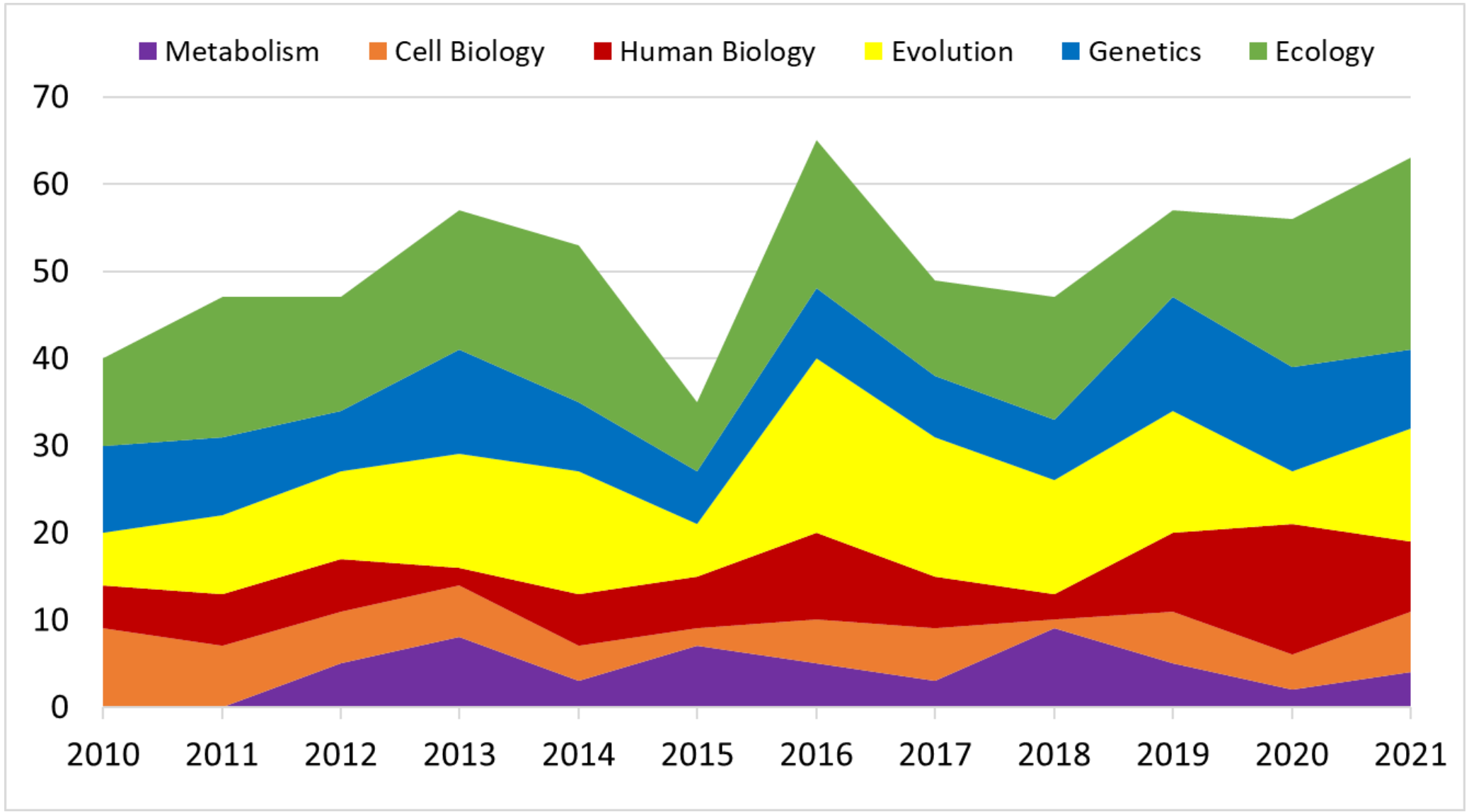

Number of articles in biology education by country.
NUMBER OF ARTICLES
1.000
100
10
1
USA
Germany
Sweden
Australia
Spain
UK
Israel
Greece
Turkey
Netherland
Austria
Taiwan
Korea
Finland
South Africa
Japan
China
Canada
Slovenia
Holland
Cypre
Portugal
India
Hong Kong
Franda
Chile
Uganda
Singapore
Noruega
New Zeland
Malasia
Italia
Colombia
Belgium
Argentina
Thailnd
Switzerland
Slovakia
Serbia
Saudi arabia
Poland
Pakistan
Nepal
Montenegro
Mexico
Kenia
Jordania
Gana
Filipinas
Estonia
Denmark
Croatia
Costa Rica
Brunei
Brazil

Results

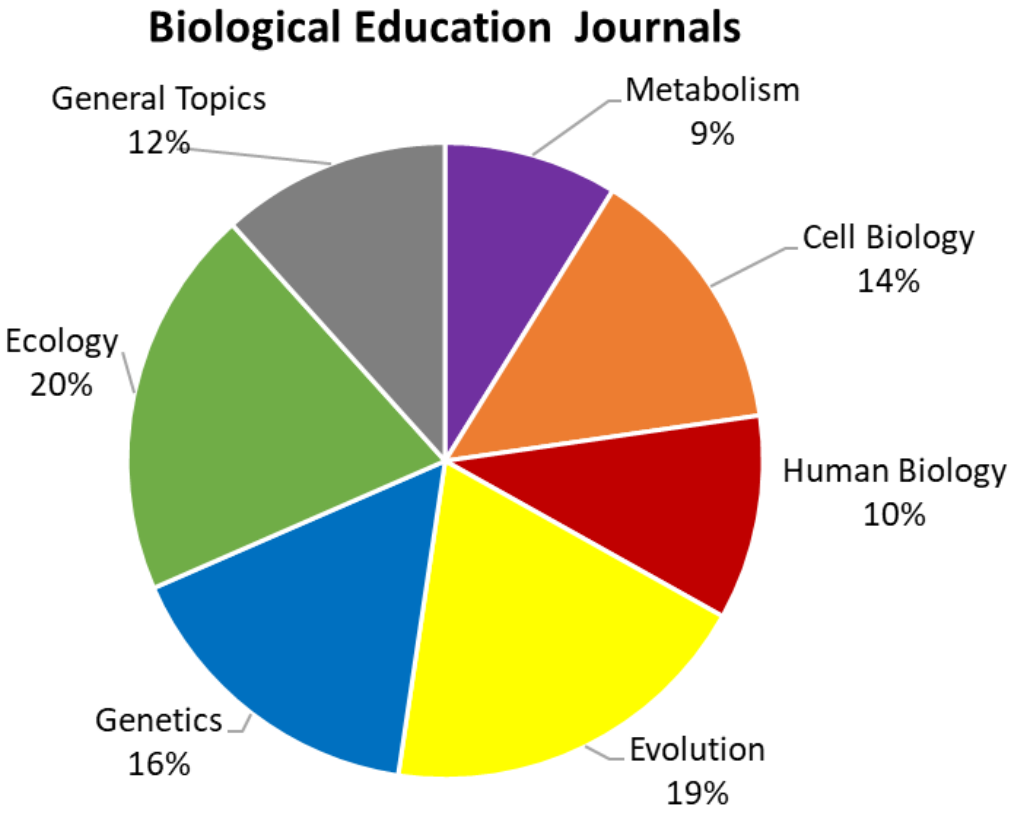
Number of articles in biology education by content topic.

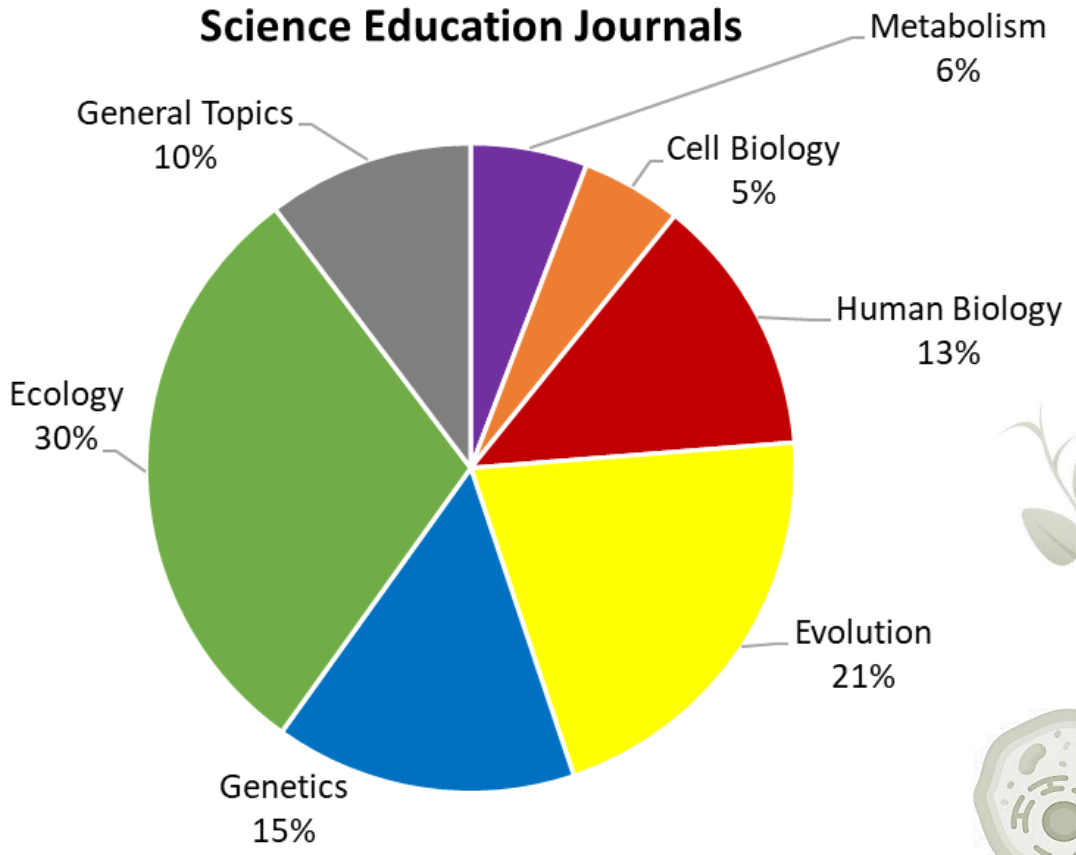


Results


Number of articles in biology education by year
Metabolism
Cell Biology
Human Biology
Evolution
Genetics
Ecology
70
60
50
40
30
20
10
0
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021

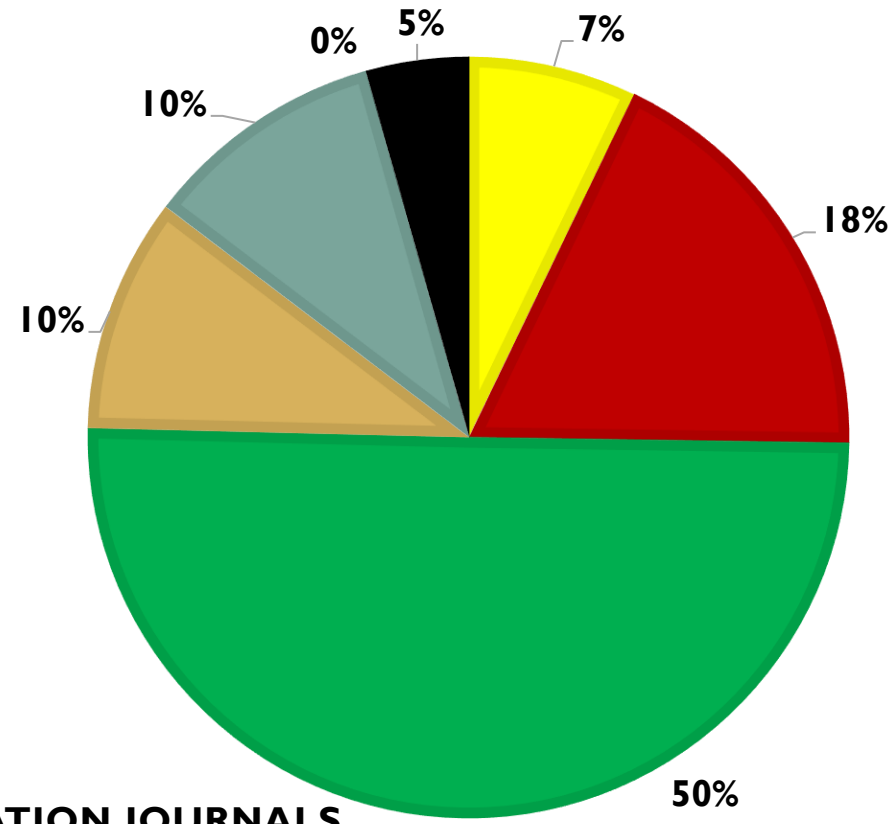
Results


Biological Education Journals
General Topics 12%
Metabolism 9%
Cell Biology 14%
Ecology 20%
Human Biology 10%
Genetics 16%
Evolution 19%


Science Education Journals
Metabolism 6%
General Topics 10%
Cell Biology 5%
Human Biology 13%
Ecology 30%
Evolution 21%
Genetics 15%

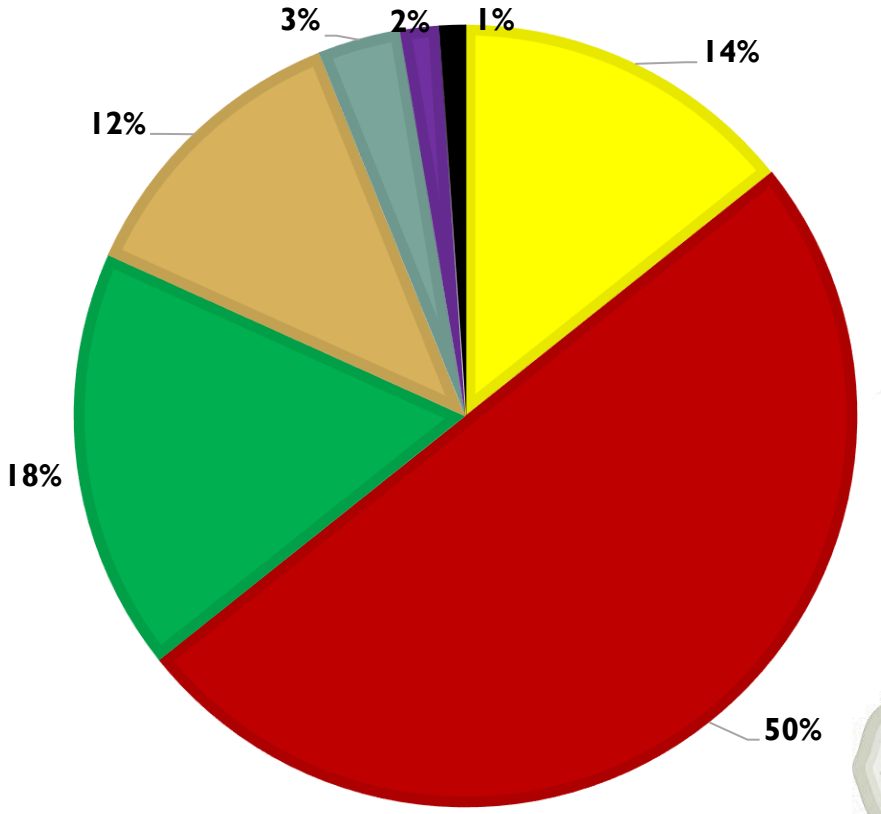
Results

- Pre-school & Elelementary School
- Middle & High school
- University level
- Teachers (pre-service and in-service)
- All school levels
- General public
- Books



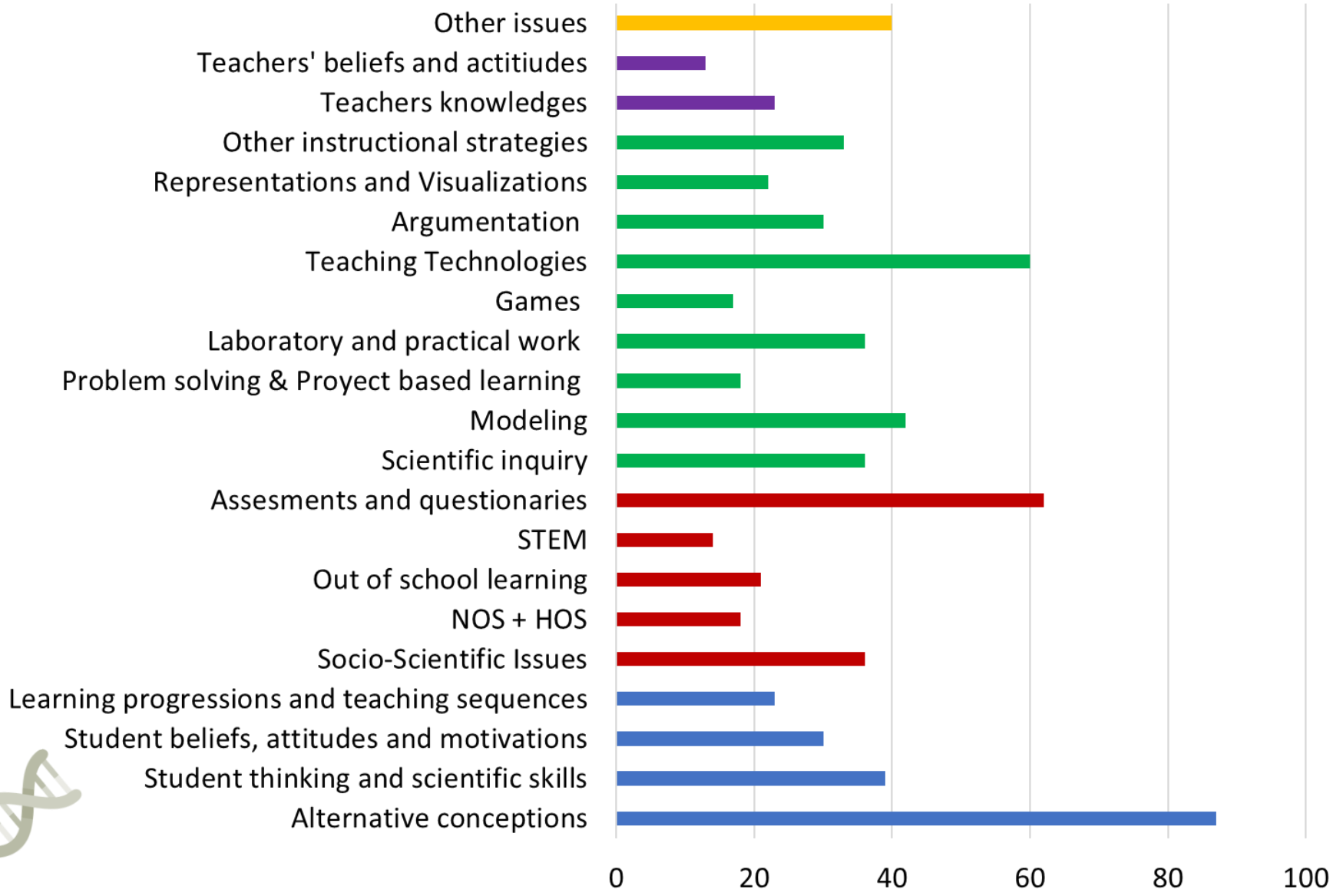
BIOLOGY EDUCATION JOURNALS

SCIENCE EDUCATION JOURNALS



Results

Number of articles in biology education by science education topic.



Discussion and Conclusion

- As found Teo et al., (2014) for Chemistry education research trends, most of the studies published in biology education in the last decade in the top-tiered science and biology education journals, were done in USA and other few European countries

- Studies of biology education were focused mostly on higher education (specially in biology education journals) and high school context (science education journals).

- Alternative conceptions are still a major topics in biology education research literature, but other issues emerge such as argumentation, Socio-scientific Issues, ICT and Modeling (e.g., Odden et al., 2021).

- There is no clear time trend in the development of biology education research, with large fluctuations between years.

Discussion and Conclusion

Considering the results, topics that need further study are learning and teaching at the pre-school level, and in specific topics of cell biology and human biology. Within the latter, more research is urgently needed on topics such as the nervous system or developmental biology (Kampourakis & Reiss 2018).

Furthermore, more research about biology education should come from South American and African countries

Finally, further reviews are needed to assess whether the different topics within biology education are being developed equitably at different educational levels or in different biology disciplines.

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