

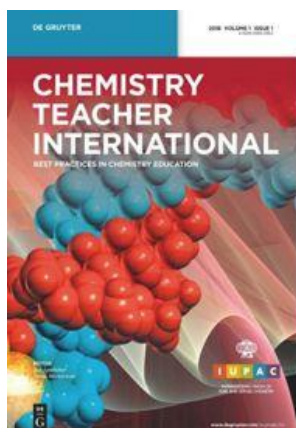
## **Chemistry Teacher International, a new IUPAC Journal**

Jan Apotheker,

editor in chief, (past) chair of CCE IUPAC

### **Introduction**

The IUPAC journal Chemistry Teacher International (CTI), Best practices in Chemistry education (ISSN:2569-3263), is now in its fourth year of existence. In 2019 issues 1.1 and 1.2 were published, and in 2020 issues 2.1 and 2.2. In 2021 four issues were published, including two special issues, one on polymer science, together with division IV (polymer division), and one on green chemistry together with CHEMRAWN (Committee on Chemical Research Applied to World Needs), Division VI (Chemistry and the environment division) and COCI (Committee on Chemistry and Industry). Four issues are planned for 2022. In this article we report on the first three years of the journal's existence – the rationale for its establishment, the composition of the editorial board, its funding model, authorship and readership.



*Figure 1. Cover page of issue 3.2*

### **Rationale**

The journal was initiated by the Committee on Chemistry Education of IUPAC, in cooperation with the Division of Chemistry Education of EuChemS. Both committees agreed that a truly international journal was needed, that was easy to access for teachers. For the development of education, the exchange of experiences, positive and negative, is essential. The description of good practices by teachers for teachers in a more international setting should broaden the scope of teachers, beyond developments in their own country. Since travel abroad for teachers normally is very limited, an online, freely accessible journal will help inspire teachers. Both committees decided an international journal was needed for articles focusing on

- Good practice in chemistry education at all levels

- Reports about development in chemistry education
- Bridging the gap between research and classroom practice(Herrington & Daubenmire, 2016)
- Papers presented in conferences about Chemistry education such as ICCE, ECRICE, NICE, ACRICE, EUROVARIETY
- Reports on educational activities of IUPAC divisions and standing committees.

There is only a limited number of international journals(about 20) dedicated to Science- and or Chemistry - education research(Kreke et al., 1998; Towns & Kraft, 2012). By now there may be a few more. Most of these journals have a subscription model and are mainly focused on research in science education.

In 2016 Keith Taber(Taber, 2016) wrote an editorial in Chemistry Education Research and Practice (CERP), titled ‘What is wrong with ‘practice’ papers’. In the article he explained why several types of papers are not published in CERP. More specifically he explained and argued what chemistry education research is and what it is not. He went on to explain why good practice papers should not be published in CERP. Basically, his idea was that reports on good practices,in general, do not add to the scientific knowledge and educational knowledge as such.

The Committee on Chemistry Education agreed that good practices are not necessarily chemistry education research. In some cases, they might be, but not as a general rule. That does not mean publications on good practices are not important. Reports about good practices can play an important role in improving education. An article about a way in which a flipped classroom was used, that also tries to explain why this worked in that particular situation, may inspire another teacher to try something similar in his or her own situation.

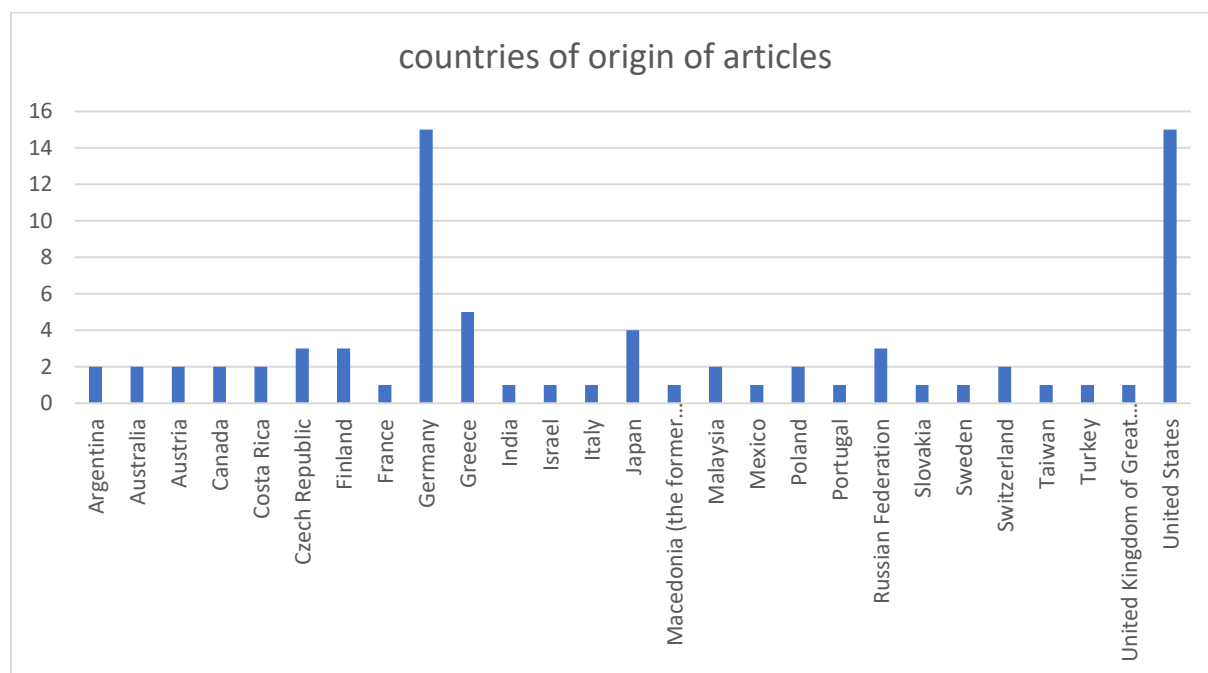
Journals publishing good practices in secondary education are mainly national teacher journals, like ‘The Science Teacher’ published by NSTA, Education in Science, published by the ASE in the UK, ‘Chemie&Schule, published in Austria, Chemkon, published in Germany, NVOX, published in the Netherlands, and ‘La chimicanellascuola’ published in Italy.Up to now there were very few international journal publishing good practices in chemistry education.

Since most teachers in secondary schools do not have access to journals with a subscription model, it was decided to let CTI be an open access journal, available to everybody with an internet connection. That means no subscription fees, but instead an Author Processing

Charge(APC). For the first two volumes the fee was paid by DeGruyter(publisher) and IUPAC. The APC was set at € 375, and was implemented since July 2021. In order to stimulate publications from around the world, there is a reduction scheme (50% or 100% reduction), based on the economic situation of countries. Members of IUPAC receive a 33% reduction. Apart from that the editorial board can invite authors to publish and waive the APC.

### Origen of articles received

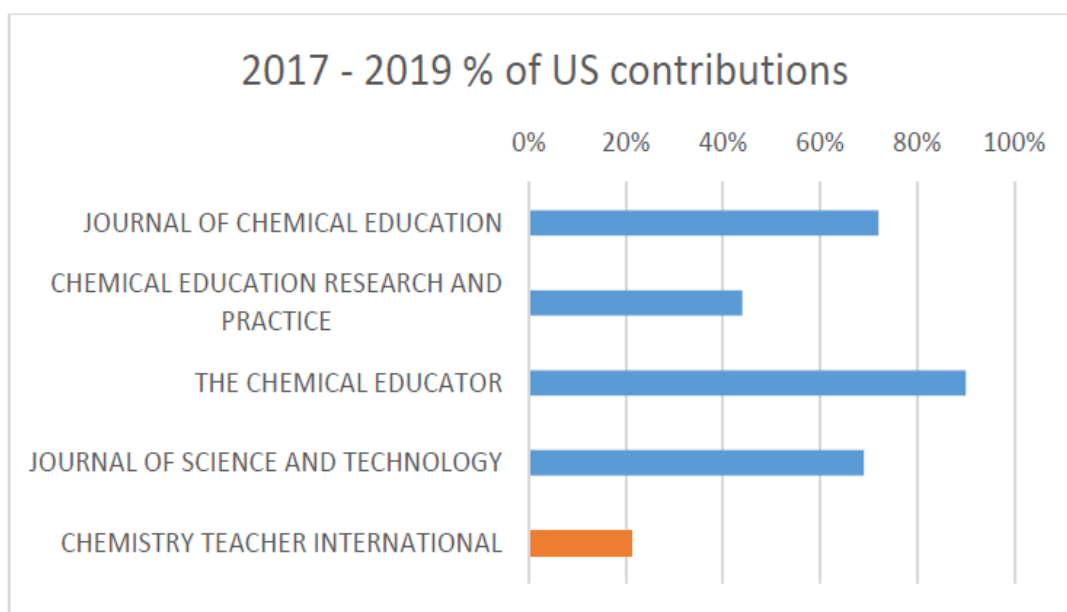
From the start, the journal has had no problem attracting articles from an international group of authors. In figure 2 the country of origin of the first 82 articles is given. By now(November 2021) more than 100 articles have been received.



*Figure 2. Countries of origin of authors in CTI.*

Recently an article discussing research on education in Ethiopia and Indonesia was received. Especially for teachers in Africa it is important to have an international forum, where they can exchange information about their educational research and developments.

To demonstrate the international character of CTI the article source of some research journals is given in figure 3:



*Figure 3. Article source in several journals on Chemistry Education*

It's clear that there is no dominance from one particular country in the source of articles, indicating CTI is truly an international journal, encompassing all regions of the world. The educational board that was formed reflects this idea. The composition is given in table 1.

Table 1. Editorial board of CTI

Name and email	Institution	Country	Region
Jan Apotheker, <a href="mailto:J.H.Apotheker@rug.nl">J.H.Apotheker@rug.nl</a>	University of Groningen	The Netherlands	Editor in chief, CCE (Europe)
Rachel Mamlok, <a href="mailto:rachel.mamlok@weizmann.ac.il">rachel.mamlok@weizmann.ac.il</a> ,	Weizmann Institute	Israël	Vice-editor in chief, Division on Chemistry Education (Middle-East)
Suzanne Boniface, <a href="mailto:suzanne.boniface@vuw.ac.nz">suzanne.boniface@vuw.ac.nz</a> ,	Victoria University of Wellington	New Zealand	Australia/ New Zealand
Mei-Hung Chiu, <a href="mailto:mhchiu@gapps.ntnu.edu.tw">mhchiu@gapps.ntnu.edu.tw</a> ,	National Taiwan Normal University	Taiwan	Asia (Network for Inter-Asian Chemistry Educators)
Marietjie Potgieter, <a href="mailto:marietjie.potgieter@up.ac.za">marietjie.potgieter@up.ac.za</a> ,	University of Pretoria	South Africa	Africa (African Conference on Research in Chemistry Education)
Ian Butler, <a href="mailto:ian.butler@mcgill.ca">ian.butler@mcgill.ca</a>	McGill University	Canada	North America
Iwona Maciejowska,	Jagiellonian	Poland	Europe (European

<a href="mailto:iwona.maciejowska@uj.edu.pl">iwona.maciejowska@uj.edu.pl</a>	University in Krakow		Conference on Research in Science Education, EuroVariety)
Alejandra G. Suárez, <a href="mailto:asuarez@fbioyf.unr.edu.ar">asuarez@fbioyf.unr.edu.ar</a>	National University of Rosario	Argentina	Latin America
Ethel Orlando <a href="mailto:Ethel.rios1@upr.edu">Ethel.rios1@upr.edu</a>	University of Puerto Rico	Puerto Rico	Representative CPCDS

The editors are not only responsible for the review process (each paper is reviewed by two external reviewers), but also play a role in soliciting papers within their region. Based on the success of the first two years CTI has been accepted in SCOPUS and EBSCO-host, two major search engines. It means CTI will receive an impact index within Scopus. CTI has submitted a request to be accepted within the Social Science Citation Index as an emerging journal.

### Readership

Over the first two years some data have been collected about the use of CTI. These are given in figures 4 and 5. These data indicate that the readership of CTI is growing. It is also clear that marketing is needed in order to increase the readership.

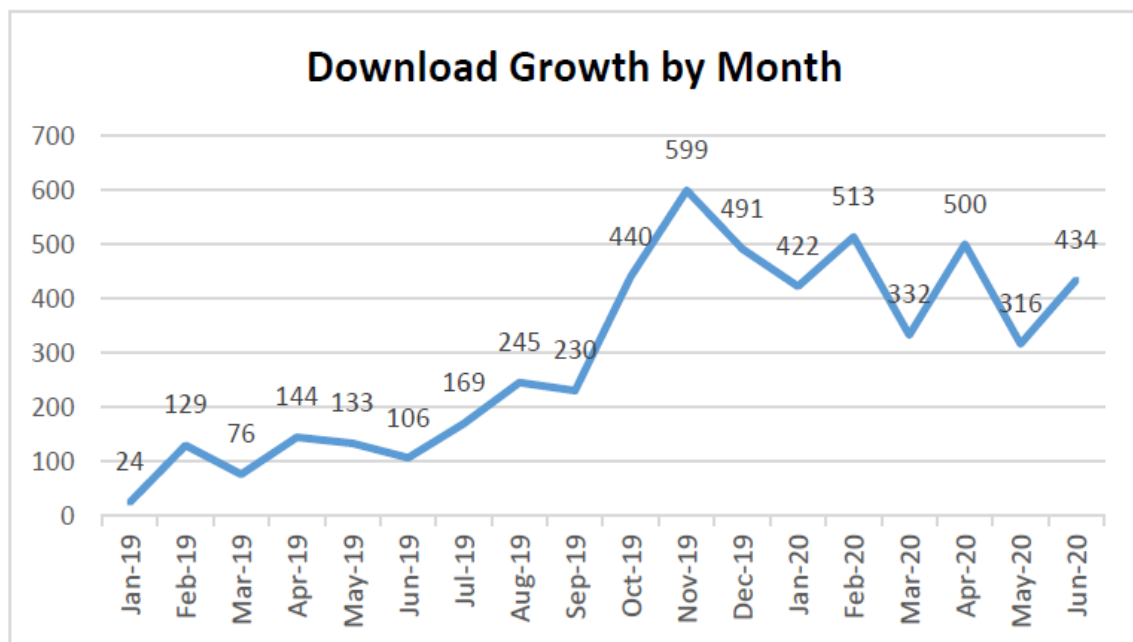


Figure 4. Download growth of CTI in numbers

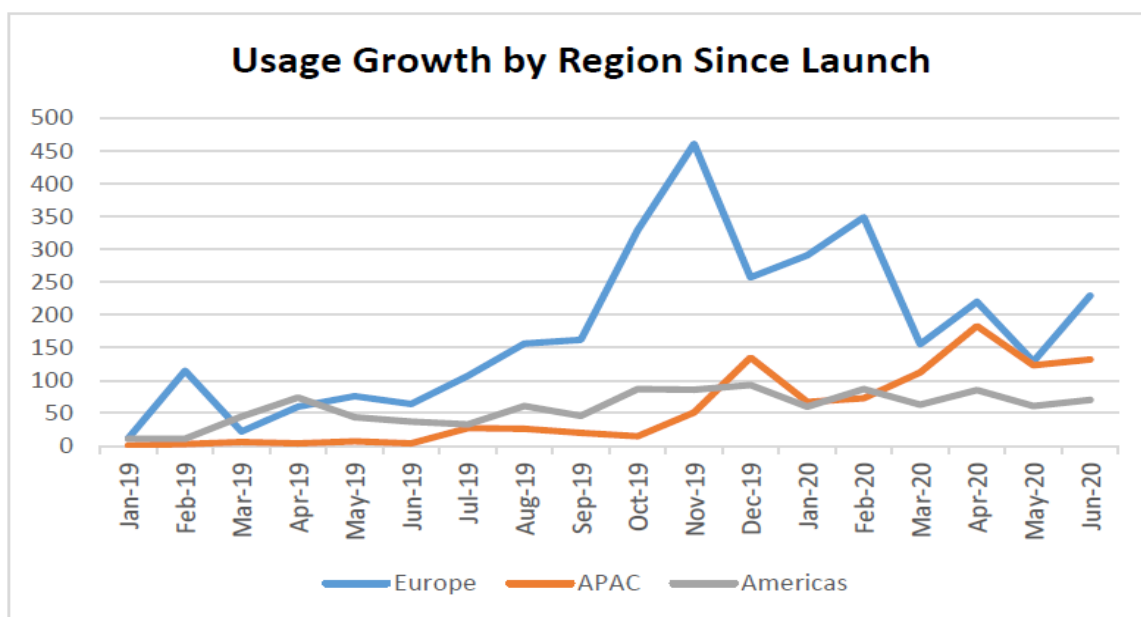


Figure 5. Usage growth by region

## Special Issues

The editorial board has decided to publish at least one special issue per year. These special issues focus on a specific theme. In June 2021 a special issue was published with Polymer Science as a central theme. The content of that special issue is given in table 2.

Table 2. Content special issue Polymer Science

Authors	Title
Catherine L. Moad and Graeme Moad (Moad & Moad, 2020)	Fundamentals of reversible addition–fragmentation chain transfer (RAFT)
Ali Bagheri, Suzanne Boniface, Christopher M. Fellows (Bagheri et al., 2021)	Reversible-Deactivation Radical Polymerisation: chain polymerisation made simple
Stanislaw Penczek, Julia Pretula and Stanislaw Slomkowski (Penczek et al., 2021)	Ring-opening polymerization
Nurul Fatahah Asyqin Zainal, Jean Marc Saiter, Suhaila Idayu Abdul Halim, Romain Lucas and Chin Han Chan	Thermal analysis: basic concept of differential scanning calorimetry and thermogravimetry for beginners

(Zainal et al., 2020)	
Daniela Held, Peter Kilz (Held & Kilz, 2021)	Size-exclusion Chromatography as a Useful Tool for the Assessment of Polymer Quality and Determination of Macromolecular Properties
Suhaila Idayu Abdul Halim, Chin Han Chan and Jan Apotheker (Abdul Halim et al., 2021a)	Basics of teaching electrochemical impedance spectroscopy of electrolytes for ion-rechargeable batteries – part 1: a good practice on estimation of bulk resistance of solid polymer electrolytes
Suhaila Idayu Abdul Halim, Chin Han Chan and Jan Apotheker (Abdul Halim et al., 2021b)	Basics of teaching electrochemical impedance spectroscopy of electrolytes for ion-rechargeable batteries – part 2: dielectric response of (non-) polymer electrolytes
Tamaki Nakano, Adriana Pietropaolo and Masahiro Kamata (Nakano et al., 2021)	Chirality analysis of helical polymers
Volker Abetz, Torsten Brinkmann and Mustafa Sözbilir (Abetz et al., 2021)	Fabrication and function of polymer membranes
Denis M. Zhilin and Andrij Pich (Zhilin & Pich, 2021)	Nano- and microgels: a review for educators
Christine K. Luscombe, Uday Maitra, Michael Walter, Susanne K. Wiedmer (Luscombe et al., 2021)	Theoretical background on semiconducting polymers and their applications to OSCs and OLEDs
Masaru Matsuo, Rong Zhang, Yuezhen Bin (Matsuo et al., 2021)	An understandable approach to the temperature dependence of electric properties of polymer-filler composites using elementary quantum mechanics
Jiří Vohlídal (Vohlídal, 2020)	Polymer degradation: a short review

For the next special issue that will be published December 2021, a call was sent out, requesting papers concerning the theme: “Examples of the use of the principles of Green Chemistry and Sustainable Development in the design of industrial processes for secondary chemistry and for introductory chemistry courses”.

In many chemistry curricula Green Chemistry has become a feature. The curriculum in the Netherlands is an example (Apotheker, 2018). In introductory chemistry courses in higher education more and more attention is given to the principles of green chemistry (Hjerensen et al., 2000), as well as the ideas of sustainable development (*UN Sustainable Development Goals*, n.d.). This includes design principles like ‘cradle to cradle’, ‘cradle to grave’ as well as life cycle analysis (Braungart & McDonough, 2002).

The number of concrete examples to illustrate these principles, that are used in education at this moment, is limited, even though there are many recent examples. Within chemistry education it is important for students to understand the role that chemistry plays in society. One of these roles is to apply chemical knowledge to design processes that implement the principles of Green Chemistry and help in Sustainable Development. In order to demonstrate the role of chemistry, more information for teachers is needed, so they can use this information and share this with their students.

In December, 2022 a special issue on chemistry and cultural heritage will be published. As argued above it is important for students to recognize the role of chemistry in society. Articles about the use of chemistry by indigenous people are expected, as well as articles about the use of chemistry in the restoration of works of art (Figure 3).



Figure 3. *Still Life: vase with 12 Sunflowers*, van Gogh (Neue Pinakothek)

### **Contribution to IUPAC**

Chemistry Teacher International has made a flying start, and continues to attract enough articles to be able to publish at least 4 issues a year. It is clear that CTI will contribute to the development of chemistry education internationally. CTI clearly fills a gap between chemistry education research and the activities in the classroom. CTI still needs to grow further and work is needed in the future to make sure it stabilizes and reaches a large group of teachers with an international orientation.

For IUPAC, CTI is a journal in which the divisions and standing committees can showcase their activities to an important group. Chemistry education, both in secondary schools as well as in introductory courses is an ideal platform to demonstrate the important role of chemistry in society, and the role IUPAC has within the chemistry community. The special issues of CTI, but also articles in general issues, can be used to highlight IUPAC's activities. The special issues so far have been supported by different divisions and standing committees. The editorial board will welcome other initiatives from IUPAC to reach out to the educational community.

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