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Specialization, Chemistry, and Poetry: Challenging Chemistry Boundaries

João Carlos Paiva,[†] Carla Morais,[†] and Luciano Moreira*[,‡]

[†]CIQUP, Unidade de Ensino das Ciências, Departamento de Química e Bioquímica, Faculdade de Ciências, Universidade do Porto, 4169-007 Porto, Portugal

[‡]CIQUP, Faculdade de Engenharia, Universidade do Porto, 4200-465 Porto, Portugal

ABSTRACT: Modern societies moved towards academic and professional specialization, and human activity has been rigidly structured and split. The enduring gap between science and art, which academic curricula mirror and sustain, reproduces rather than changes the patterns of social inclusion and exclusion. In this commentary, we review some empirical endeavors to merge poetry with chemistry from an ecological, developmental, and constructivist perspective. It seems important to involve students in structured activities promoting a socio-historical understanding of the opportunities and constraints acting on chemistry, the significance of chemistry theories and methods, and a holistic approach to chemistry as a field of self-expression and social commitment. By merging poetry with chemistry, we expect not only that students learn chemistry, but also that they develop scientific literacy skills as well as a more critical view on the co-extensiveness of modern challenges.

KEYWORDS: *High School/Introductory Chemistry, Interdisciplinary/Multidisciplinary, Communication/Writing*

QUESTIONING THE BOUNDARIES OF SPECIALIZATION

Modern societies moved toward specialization.[1] Religion, science, and art have become separate realms of human activity.[2] Specialization usually occurs through school, which in turn mirrors and sustains social discourses and labor markets. Most socially prestigious and well-paid occupations require higher academic qualifications. As cultural capital is correlated with academic achievement, school often reproduces social structures and fails to diminish cultural imbalances.[3]

According to common representations, scientific tasks involve skills such as observation and analysis, or attitudes such as rigor and method (model of objectivity); conversely, artistic tasks involve skills such as creativity and divergent thinking, or attitudes such as irreverence and originality (model of subjectivity): "As students move further along in school the gulf deepens, so that by graduate school it is a rare student who takes courses outside his or her field".[4]

Chemistry teachers are primarily concerned with students' learning. Methods that challenge the limits of curricula and classes may help chemistry students to perform better.[5] In this commentary, we will review and comment on some empirical works on merging poetry with chemistry from an ecological, developmental, and constructivist perspective.

BRINGING POETRY TO CHEMISTRY CLASSES

Considering the pervasive process of specialization, it is not surprising that we have found few papers on the merging of poetry and chemistry. However, there are some empirical works from primary education to high school,[6] including efforts to use the students' grammar knowledge to teach chemistry as if it was a second language.[7]

In an interdisciplinary effort, Herrick and Cording[8] organized a critical reading of a poem in an upper-level course on bioinorganic chemistry. Although the activity was simple, the authors were surprised by the high level of students' involvement, stressing "they enjoy using their talents in the humanities to think about important chemical concepts in a nontraditional way". The discussion was enriched by the different backgrounds of the organizers, who offered students an example of cooperation.

A more demanding activity is described by Furlan and colleagues,[9] who, for eight years, merged poetry writing and poster illustration with chemistry at a college level. Students were given two seminars on writing poetry and illustrating posters and then challenged to illustrate a poster that should include a poem on a chemistry theme. It is possible to organize students' attitudes toward the project in three dimensions:

1. A hedonistic dimension ("made chemistry more enjoyable")
2. A cognitive or instrumental dimension ("helped review concepts/made chemistry more understandable"; "helped demonstrate chemistry knowledge")
3. An expressive dimension ("allowed them to be creative and unique, added variety to the class")

Local actors valued students' posters as they helped them to get in touch with chemistry. Instructors acknowledged the diversity of themes treated and observed that the "best poems

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were not necessarily produced by the A-level students but actually often by B- or C-level students".[9] In brief, poetry helped students to "learn and express chemistry in a fun and creative way".[9]

Similarly, Marcum-Dietrich and colleagues[10] implemented and reported positive outcomes on engaging chemistry students in creative writing. The project resulted from the cooperation between an English teacher and a science teacher. It consisted of two parts. First, students were asked to write a poem on gases according to a structured script with the topics. Then, students were asked to read one of John Updike's poems and write an essay on the properties of a crystal or a neutrino, exclusively based on the reading of the poem. As the project proved successful, the authors not only repeated it, but also included other literary activities (e.g., a children's book). Eventually, the experience led to changes in the chemistry curriculum as writing became a central feature in it.

According to Alber,[4] creative writing in chemistry classes is an academic experience positively valued by students. It helps them (i) to value less obvious psychological processes involved in chemistry, such as creativity; and (ii) to be more aware of the personal tensions related to scientific endeavors.

Some Affective and Aesthetic Benefits for Students

From an ecological point of view, there are three aspects that must be considered. First, in one way or another, all these projects go beyond the boundaries of chemistry, taking advantage of the impact of ecological transitions.[11] When students are engaged in critical reading or creative writing (especially if their works are to be publicly presented), they assume another position (e.g., someone who is cooperating in the dissemination of chemistry). Second, the interdisciplinary approach strengthens students' development by requiring them to carry over "to other settings and other times"[11] skills that are typically acquired elsewhere (e.g., English).[8] Third, the teachers' commitment appears to be a key feature. It would be interesting to learn how they felt and what their personal motivations were. How did these experiences affect teachers' subsequent involvement in classes? Did the effects eventually extend to other teachers? Williams gives us a good example of self-assessment on an activity that consisted of reading limericks written by students on chemistry topics: "The class seemed to enjoy the short break each day; their professor certainly did".[12]

From a developmental point of view, we would like to highlight two features. First, in a moment when students are usually asked to make their first vocational choices, and given that identity formation is closely related to vocational commitment,[13] these activities allow them to perceive heterodox and more meaningful ways to integrate chemistry and poetry in their lives. Additionally, these projects may help students to overcome the angst of loss (inherent to the process of choice) devising more complex possibilities of personal investment, which are not circumscribed by the choice of an occupation. Second, it would be important to understand whether these projects explore the zone of proximal development.[14] The strategic axis would be clearer to us had the authors described how, or if, doubts and help requests were handled by teachers and, broadly, how students interacted among themselves.

From a constructivist point of view, it is worth noting that the activities were balanced. On one hand, they implied and valued students' commitment. On the other hand, bearing in mind that human development also has a social basis,[15] the activities provided students with well-structured scripts and guidelines that led them to operate within a meaningful framework.

Some Guidelines for Teachers

A major goal of merging poetry with chemistry is to diversify the learning processes, enabling students to develop a personal significance of chemistry theories and methods. Despite the eventual advantages, because reading and writing poetry are highly demanding tasks, not all students feel comfortable with this kind of proposal. Consequently, it is important to continue appreciating students' proofs of commitment with more traditional tasks.

Teachers will have to keep students focused in relevant topics, without inhibiting their participation. By writing on the blackboard the main ideas that are present in students' opinions, teachers can lead them to higher levels of complexity, challenging common representations and promoting more accurate alternatives of perceiving chemistry (e.g., emphasizing attitudes toward collaborative work, which prevails in modern scientific research).

Through poetry, some social issues may be addressed (e.g., gender and ethnic prejudice), confronting students with the socio-historical opportunities and constraints acting on the chemistry endeavor.[16] If students are invited to speak as if they were a chemist or an ordinary person, they may feel free to explore the bonds between scientific achievements and other spheres of life, recognizing chemistry as a field of self-expression and social commitment.

■ CONCLUSIONS

The emphasis on poetry as a tool to enhance scientific literacy and chemistry learning does not intend to be universal. Not all chemistry teachers have the necessary skills and motivation to merge poetry with chemistry. Nonetheless, we think that chemistry classes should open their doors and seek interdisciplinary bonds. Poetry and creative writing are only one of many ways to establish such bonds, but it is one particularly dear to the authors.

Depending on their own motivations, interests, and skills, teachers may offer their students opportunities to learn chemistry while developing transversal skills (such as critical thinking or creativity).

Ultimately, a certain degree of specialization is needed. The problem is not specialization itself but the common process of specialization as a socially selective mechanism. As Bourdieu and Passeron[3] point out, academic content tends to lose its social value. At least, we may hope that through the diversification of opportunities, school may contribute to bridge the gaps between included and excluded students.

It is of great importance that future chemists, researchers, and practitioners may share a humanistic and critical view of their practice. Chemistry, objective as it may be, is not only present in nature: it is embedded in social and institutional structures. Thus, changing the way students typically perceive chemistry may help change society for the better.

■ AUTHOR INFORMATION

Corresponding Author

*E-mail: lucianomoreira@fe.up.pt.

Notes

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