

Teachers Access to a Brazilian Virtual Learning Community Over Time: Why They Do Not Come Back

O Acesso de Professores a uma Comunidade Virtual de Aprendizagem Brasileira ao Longo do Tempo: O Motivo Por que Eles Não Voltam

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Abstract

A virtual learning community, created in association with courses offered within an online professional development program for Brazilian biology teachers, was reviewed over a two-year period. This virtual learning community is designed to be moderated and managed solely by the teachers themselves without any guidance. The results showed a recurring participation pattern, expressed by a large number of page and message views, for short periods of time during the courses, followed by a sharp drop in those views after the courses closed. This pattern was unrelated to course subject or duration. The questionnaires revealed that teachers who did or did not access the virtual community after the end of their courses were indistinguishable from their demographic profiles or digital skills. The analysis of teachers' responses to the questionnaire showed that the lack of time due to work overload was the main reason why teachers abandoned the virtual learning community, regardless of highly positive user evaluations. The implications of the results for the future implementation of virtual learning communities in developing countries are discussed.

Keywords: In-service teacher education. Lifelong learning. Virtual Learning Communities.



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Resumo

Uma comunidade virtual de aprendizagem criada em associação com cursos oferecidos dentro de um programa online de desenvolvimento profissional para professores de Biologia foi analisada durante um período de dois anos. Essa comunidade foi desenvolvida para ser moderada e gerenciada exclusivamente pelos próprios professores, sem nenhum tipo de direcionamento. Os resultados mostraram um padrão recorrente de adesão, expresso por um grande número de visualizações de páginas e mensagens por curtos períodos de tempo durante os cursos, seguido por uma queda acentuada dessas visualizações após o encerramento deles. Esse padrão não estava relacionado ao assunto ou à duração dos cursos. Os questionários revelaram que os professores que acessaram ou não a comunidade após o término de seus cursos eram indistinguíveis em relação a seus perfis demográficos ou habilidades digitais. A análise das respostas dos professores ao questionário mostrou que a falta de tempo devido à sobrecarga de trabalho foi a principal razão pela qual os professores abandonaram a comunidade virtual de aprendizagem, independentemente das avaliações altamente positivas dos usuários. As implicações dos resultados para a futura implementação dessas comunidades em países em desenvolvimento são discutidas.

Palavras-chave: Formação de professores em serviço. Aprendizagem ao longo da vida. Comunidades virtuais de aprendizagem.

1. Introduction

The Internet has increasingly impacted the way people have engaged in social relations (BOYD; ELLISON, 2008), creating opportunities for access to and processing of information (GLASSMAN; KANG, 2012). One such opportunity is the use of virtual learning communities for professional development, enabling individuals and/or groups of geographically dispersed people to accomplish their learning goals (YANG et al, 2007).

International institutions have considered that teacher professional development is a crucial component for general educational achievement improvement (NATIONAL RESEARCH COUNCIL, 2007, OECD, 2010, UNESCO, 2008, 2011). In this context, the use of online professional development programs can provide opportunities for learning and collaboration among teachers (DEDEET AL, 2008, BROWN; NEAL, 2013, NATIONAL RESEARCH COUNCIL, 2007, PARK et al, 2007, WANG; LU, 2012, MARTINS et al, 2015). Like any online-based program, this particular virtual learning community aims at providing teachers with up-to-date development resources which they can access at their own convenience (DEDE ET AL, 2008). Teachers are driven by a personal desire to enrich their instructional practice when participating in online professional development programs (KAO; WU; TSAI, 2011). In addition, their beliefs about web-based learning are a positive predictor concerning motivation in relation to professional development through the web (KAO; TSAI, 2009). Thus, online professional development programs could be developed to help researchers find effective ways to improve teachers' capacity to use digital tools more effectively (KAO; TSAI, 2009).

A remarkable aspect of online professional development programs is the possibility of using different combination of software to create online environments that allow the development of VLC. Such combination may include social networks (e.g. Elgg, Ning and Facebook) and online platforms such as Moodle or Blackboard. This flexibility allows for the development of environments to reach specific goals. However, Tsiotakis and Jymommianes (2016) suggest that those environments may limit opportunities for self-directed learning because they are frequently tutor-centered or focus on formal education.

Official documents in Brazil have also repeatedly stated that improving teachers' professional development is crucial for the country to overcome its serious educational deficits (BRAZIL, 2006, CONAE, 2010). However, little is known about the implementation or the use of virtual learning communities by teachers in that country. An early report analyzed the activities of a small group of Brazilian Biology pre-service and in-service teachers; and researchers in Science Education in a virtual learning communities (EL-HANI; GRECA, 2013). The authors concluded that the participants actively exchanged materials, engaged in discussions related to their teaching practices and developed teaching strategies and techniques. Those findings, among others, have led the authors to conclude that the virtual learning community functioned as a Community of Practice (EL-HANI; GRECA, 2013).

Another previous study analyzed the participation of 204 biology teachers enrolled in formal online professional development programs in a virtual learning community (VLC-Bio) (ROLANDO et al, 2014). In that study, the community was open exclusively for elementary and high school teachers who freely interacted with their peers for a period of four weeks. The aim of that approach was to foster teachers' autonomy in the process of developing the VLC-Bio, focusing primarily on their own goals and interests rather than relying on the opinions and criteria of researchers or other professionals. Differently, from the online professional development programs itself, VLC-Bio had no moderation by tutors or mentors, either during or after the online professional development programs (ROLANDO et al, 2014). The results of that study showed that teachers benefited from the use of the VLC-Bio by intensely sharing teaching resources (e.g. texts, pictures, videos and weblinks) and professional expertise (ROLANDO et al, 2014).

Those findings corroborate El-Hani and Greca's (2013) study in the sense that virtual learning communities may be important tools for the professional development of Brazilian teachers. Despite the positive results obtained in that earlier study, it did not address the issues related to the teachers' use of the VLC-Bio after the end of the online professional development programs. In the research reported here we investigated if the positive experience in a virtual learning community could lead to the establishment of a lasting autonomous virtual learning community of teachers. To address that issue, we have investigated the frequency of use of the VLC-Bio during two years as well as the teachers' self-reported reasons for using (or not) the VLC-Bio after the end of their online professional development programs courses.

2. Methodology

2.1. The teacher online professional development programs

The CECIERJ-online professional development program (C-OPDP) consists of several distance education courses offered exclusively online using the Moodle platform. The courses are offered by the CECIERJ Foundation and are intended for biology teachers working in public schools. All courses deal with relevant Biology-related contents combined with the use of Internet tools. Each course had an estimated workload of 30 hours and was moderated by tutors (SALVADOR et al, 2010). When registering for the C-OPDP, teachers filled out a survey concerning their use of internet, also providing some basic sociodemographic data such as gender and age (ROLANDO; SALVADOR; LUZ, 2013).

2.2. The virtual learning community VLC-Bio

Four weeks before the end of each C-OPDP course, the teachers were asked by their tutors to join and to perform at least two participations in a Virtual Learning Community (the VLC-Bio, see below). A total of 705 (91%) out 775 registered teachers effectively joined the VLC-Bio. A period of four weeks was allowed in each course for teachers to join the VLC-Bio. That approach combined the formal characteristics of an online professional development program with the less hierarchical structure of an independent VLC-Bio that was expected to foster self-directed learning and collaboration.

The VLC-Bio was based on the online platform Ning Network, which enables the creation of individualized social networks based on users' shared interests. Members had permanent access to the VLC-Bio. All members' activities were recorded and made immediately accessible to all other members. The Ning software provided tools designed for interaction and collaboration among network members, such as creating forums, blogs, groups, writing messages and sharing various types of files (e.g. videos, images and texts).

2.3. Analysis of the frequency of use of the VLC-Bio

Members of the VLC-Bio, the teachers, were able to interact freely with their peers for as long and as frequently as they wished. VLC-Bio was managed exclusively by its members. Teachers were free to perform all activities available in the VLC-Bio, creating new spaces of discussion (Forums and Blogs); posting messages in existing Forums or Blogs and uploading or downloading files. The teachers were not monitored or guided by tutors when interacting in the VLC-Bio.

After joining the VLC-Bio, teachers enrolled in C-OPDP were asked to engage in at least two activities during a period of four weeks, herein called Stimulated Period. For practical reasons each Stimulated Period was considered to end on the last day of the course.

The time between the end of a Stimulated Period and the beginning of the next will was called Spontaneous Period. During Spontaneous Periods there was no encouragement whatsoever by the tutors from the C-OPDP for teachers to access the VLC-Bio. Spontaneous periods lasted eight weeks in Year 1 and sixteen weeks in Year 2 of the present research.

2.4. Data from the VLC-Bio use

The data on the use of the VLC-Bio analyzed in this study were obtained through Google Analytics (www.google.com/analytics/), which provided only anonymous data on traffic such as how many people accessed the site, when, how often, among other parameters.

2.5. Questionnaire

A questionnaire aimed at evaluating teachers' perceptions of their experience in the VLC-Bio (Appendix 1) was sent to the 705 teachers enrolled in the courses that effectively became members of the VLC-Bio during the five stimulated periods. The questionnaire consisted of five assertions followed by a request for justification and a final objective question, for which the respondents also had to provide a justification. Each of the five assertions was presented using a Likert scale of five alternatives (strongly disagree, disagree, neither agree nor disagree, agree and strongly agree). Scores ranging from 1 to 5 were attributed to each alternative in each assertion. Mean scores were calculated for each assertion. An inversed scale was used to calculate the score of Assertion V because of its negative enunciation (Appendix 1).

The sixth and last item of the questionnaire was the question “After the end of the course that you have attended in the CECIERJ Foundation, have you participated in the virtual community again?” (Appendix 1). After answering “Yes” or “No”, teachers had to elaborate on their reasons for returning or not to the VLC-Bio after their courses’ closure.

The analysis of the teachers’ justifications for each assertion and of the final open question was conducted following a procedure of content analysis in which data are identified and coded (FRAENKEL; WALLEN, 2008). After a lengthy discussion of the emerging categories and their meanings, all answers were independently categorized by two coders. An agreement of 89% was obtained between the two coders. In cases where disagreements on coding emerged, the categorization was performed by consensus (Table 1). Statistical tests were conducted using GraphPad Prism 5.0.

Table 1: Categories regarding the reasons given by teachers to use or not the VLC-Bio in spontaneous periods.

Answer	Category	Definition	Examples
Yes	Keeping up-to-date	Catching up on biology themes and new ways of teaching biology.	<i>I went back to using the community to see if there were suggestions of activities to work with environmental education themes.</i>
	Social Interactions	Interaction with other members of the community	<i>To exchange ideas, keep in touch and talk with virtual friends</i>
No	Lack of time.	Lack of time.	<i>On week days and also on Sundays I have very little time, so I had to prioritize my tasks.</i>
	Lack of interest.	Lack of interest.	<i>It did not arouse my interest during the course and even less afterwards.</i>
	Lack of information	Lack of information on keep using the VLC-Bio	<i>I thought the community was only available for course participants.</i>
Others		Purposes that could not be framed in the above categories.	<i>I signed up again because I loved the courses that I attended and I'm looking forward to the start of the next class.</i>

3. Results

There was a recurring pattern of intensive access to the VLC-Bio in each of the five stimulated periods (Figure 1 and Figure 2). However, each of those periods was followed by a sharp drop in access during the ensuing spontaneous periods (Figure 1 and Figure 2). There was an average of 896 pages’ views daily during stimulated periods compared with only 110 daily pages’ views during spontaneous periods. The putative reasons for that recurring pattern of intensive but transient access the VLC-Bio was investigated by means of a questionnaire sent to 705 teachers enlisted in online professional development programs courses. Eighty-eight teachers answered the questionnaire, resulting in a response rate of 12.5%.

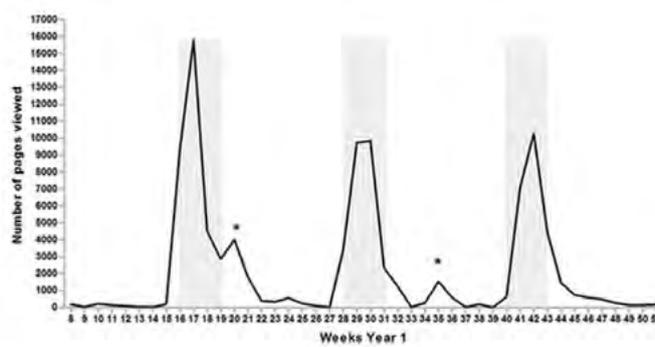


Figure 1: Number of page views over year 1. Shaded areas indicate the weeks comprising the Stimulated Periods. The remaining weeks correspond to Spontaneous Periods. * Asterisks indicate the use of the VLC-Bio by other groups of users unrelated to the C-OPDP (e.g. data collection).

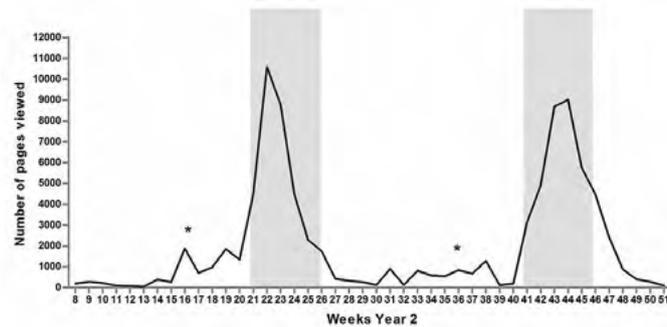


Figure 2: Number of page views over year 2. Shaded areas indicate the weeks comprising the Stimulated Periods. The remaining weeks correspond to Spontaneous Periods. * Asterisks indicate the use of the VLC-Bio by other groups of users unrelated to the C-OPDP (e.g. data collection).

Overall, the results indicate that users had a positive perception of the VLC-Bio, as mean scores of the whole sample of respondents for the five assertions were higher than three (the intermediate value of the scale – Table 2). This positive assessment made by users is confirmed by two complementary pieces of data. First, 80% of the justifications given by teachers for each one of the five assertions were positive. Secondly, each one of the five assertions received mostly positive justifications (Table 2). The possibility of learning Biology-related contents, exchanging teaching strategies with their colleagues as well as the opportunity to freely express their opinions all seem to have been important factors in the teachers' positive perception of their experience in the VLC-Bio (Table 2).

Table 2: Teachers' perceptions of their experience in the VLC-Bio (n=88)

Assertive	Score (mean ± st. dev)	Justifications			Main responses	% (of total)
		n	Type	(%)		
I	4.13 ± 0.67	67	Positive	83%	I learned new biology-related contents from colleagues	61%
			Negative	17%	There were no new contents	7%
II	4.08 ± 0.82	57	Positive	88%	I learned teaching strategies from my colleagues	73%
			Negative	12%	The discussions were not useful	6%
III	3.69 ± 0.96	55	Positives	59%	I got acquainted with and began to use those tools	25%
			Negatives	41%	I already used those tools	28%
IV	3.53 ± 1.15	42	Positives	90%	The VLC made me feel free to share my opinions	63%
			Negatives	10%	Shyness	6%
V	3.58 ± 1.10	48	Positives	57%	In the VLC I learned how to use those tools for teaching	45%
			Negatives	43%	I already used those tools for teaching	31%

A total of 63 teachers answered the objective question VI (Appendix 1). Thirty-five (55.6%) declared to have returned to the VLC-Bio after their courses' closure and 28 (44.4%) declared not to have returned. The data obtained from the survey showed that returning and non-returning teachers presented no statistically significant differences concerning their gender proportions, age and frequency of internet use (Table 3).

Table 3: Demographics of respondents.

	All respondents (n=63)	Returning (n= 35)	Non-returning (n=28)	<i>p</i>
Age (mean+ SD)	40.5 ± 10.5	39.5 ± 10	42.4 ± 11.3	0.2626 **
male	26.4%	24.4%	29.6%	0.7831*
female	73.6%	75.6%	70.4%	
Internet use#	5.8 ± 1.9#	5.5 ± 2.2	6.3 ± 1.3	0.2382 **

* Fisher's exact test, ** Man Whitney test, # Days per week.

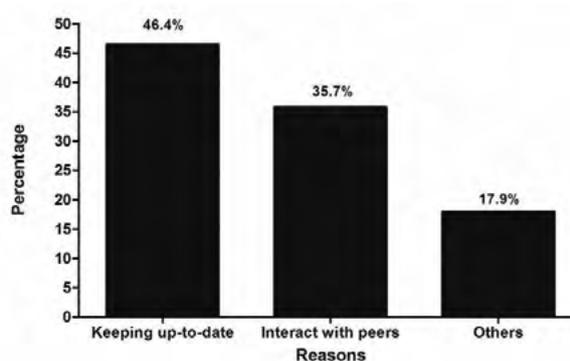
However, when the scores of returning and non-returning teachers were compared, significant differences were found for assertions I and II, indicating that returning teachers had better perceptions of their experience regarding "learning about Biology-related contents" and "learning new strategies to teach biology" (Table 4).

Table 4: Comparisons between scores from returning and non-returning teachers.

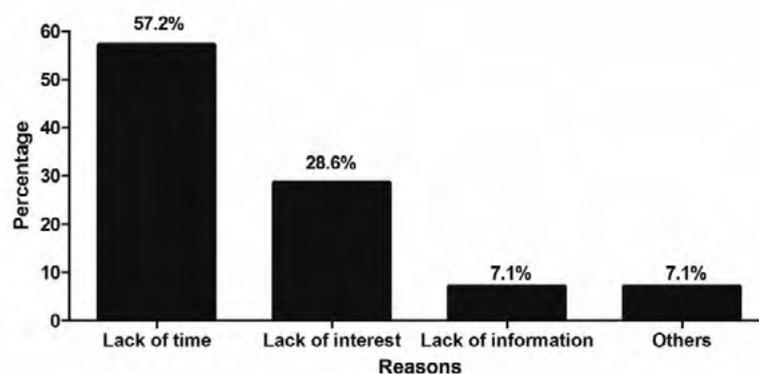
Assertive	Returning teachers (n=35)	Non-returning teachers (n=28)	<i>p</i>
I	4.31± 0.51	3.82± 0.8	0.023*
II	4.24± 0.73	3.82±0.90	0.02*
III	3.85± 0.94	3.44±0.99	0.059
IV	3.56± 1.25	3.50±0.99	0.4
V	3.69± 1.16	3.41±0.99	0.15

*Man Whitney test

The responses of the 35 teachers who declared to have returned to the community fell within three categories (Table 1). According to the majority of returning teachers, the VLC-Bio was a valuable resource since it gave them access to up-to-date biology-related contents and gave them opportunities to learn new strategies to teach Biology (Figure 3). It is noteworthy that seven teachers claimed to have returned to the VLC-Bio after the end of their courses but later lost interest due to the lack of new posts by their peers (not shown).

**Figure 3:** Reasons why teachers have returned to the VLC-Bio (n = 35).

The responses of the 28 teachers who did not return to the VLC-Bio after their courses' closure fell within three categories: lack of free time to rejoin the community mostly due to an excessive workload (Lack of Time), lack of interest for the VLC-Bio contents or resources (Lack of Interest) (Figure 4). A smaller proportion of teachers revealed not to be aware of the possibility of rejoining the VLC-Bio after the courses closure ("Lack of Information").

**Figure 4:** Reasons why teachers have not returned to the VLC-Bio (n = 28).

4. Discussion

Several studies on different virtual learning communities explore in detail the main features of such communities (MATZAT, 2013, LIN et al, 2014, ZHANG et al, 2017). However, little is known about how, when and why users join or abandon such communities. In the present study we have characterized the frequency of attendance to an exclusively virtual learning community as well as the possible reasons for teachers to join or abandon that community.

Previous studies in Brazil analyzed virtual learning communities for Biology teachers (EL-HANI; GRECA, 2013, MARTINS et al, 2015, ROLANDO et al, 2014, SALVADOR et al, 2017). In both cases, Biology teachers have been shown to actively engage in the virtual learning community activities, especially by sharing theoretical and practical knowledge, as well as personal experiences related to their teaching practices. However, both studies differ from the present report regarding the characteristics of the virtual learning community. In El-Hani and Greca's study (2013), the virtual learning community members were not exclusively teachers it also included researchers who actively joined the discussions, initiated and moderated activities. In fact, some researchers were among the most active participants of that virtual learning community. Moreover, the number of participants was moderately small, reaching 86 at the peak of the research period investigated by the authors and face-to-face interactions among virtual learning community members also occurred. The second study dealt with a sample comprising a larger number of members (204) of a virtual learning community and characterized their activities during the periods when the participants were enrolled in online professional development programs courses (ROLANDO et al, 2014). Few studies perform a long-term follow-up of the number of virtual learning community members and their participation, while just one in Brazil do present quantitative data on the total number or participation of individual members (EL-HANI; GRECA, 2013).

The results reported here corroborate the earlier finding that during stimulated periods teachers used the VLC-Bio intensively as a means of professional development (ROLANDO et al, 2014). Indeed, not only there was an active participation in the VLC-Bio but the teachers' perceptions of their experience were mainly positive, as reported in the questionnaire. For the teachers, taking part of the VLC-Bio offered opportunities to learn biology-related topics and to learn new ways of teaching from their colleagues. This result is also in agreement with a previous study carried out by Hutchison and Colwell (2011) that presented evidence that teachers were interested in each other's opinions and were able to communicate effectively in a virtual learning community. The positive perception of the VLC-Bio was true for most of the teachers who did or did not return to the VLC-Bio after their courses' closure. The returning and non-returning samples of teachers were indistinguishable regarding the available socio-demographic data and their patterns of internet use, suggesting that teachers' intrinsic characteristics do not play major roles in their decision to return or not to the VLC-Bio. Additionally, data from the questionnaire showed that neither of the two samples felt the so-called lack of trust that is known to inhibit teachers' communication in virtual learning communities (KLING; COURTRIGHT, 2003). However, non-returning teachers presented significantly lower scores for assertions concerning two factors: "learning biology-related contents" and "learning new strategies for teaching biology" than returning teachers. That result may suggest that non-returning teachers had a lower evaluation of their experience in features that were considered the most important in the virtual learning community. Such conclusion is reinforced by the fact that returning teachers highlighted those two factors among their main reasons for returning to the VLC-Bio.

Non-returning teachers, on the other hand, mentioned the lack of free time as their main reason for no longer accessing the VLC-Bio. The lack of time was mentioned almost twice as frequently as their second reason: their lack of interest for the community contents and resources. Other studies indicate that the overload of activities is characteristic of the teaching practice (BALLET; KELCHTERMANS, 2009, LUZ et al, 2018). The results presented herein can be tentatively analyzed in the light of models of dropout from online courses such as the one presented by Park and Choi (2009). It becomes clear that external factors

are the major influence on the teachers' decision not to keep accessing the VLC-Bio. That decision is thus due mostly to the lack of spare time - the schedule conflicts referred in dropout models (PARK; CHOI, 2009). In the present case, the flexibility of schedule offered by the Internet, which provides teachers with opportunities to keep up with the latest research (DEDE et al., 2008) seems not to suffice to overcome their work overload. That, in turn, does not allow them to spontaneously rejoin the VLC-Bio regardless of their positive prior experience. It seems, thus, that changes in the VLC-Bio could contribute only to a minor extent to the adherence of teachers to such a community. It is nevertheless still worth discussing which changes could prove useful. Non-returning teachers evaluated their learning of new strategies to teach biology significantly lower than returning teachers. Their second most mentioned reasons for not rejoining the VLC-Bio was their lack of interest in its contents. Taken together, those results suggest that emphasis should be given on opportunities for teachers to share their own experiences related to effective strategies to teach biology. Although the ways to make such opportunities readily available for teachers remain to be determined, their importance echoes Shulman's words: "One of the frustrations of teaching as an occupation and profession is its extensive individual and collective amnesia, the consistency with which the best creations of its practitioners are lost to both contemporary and future peers" (SHULMAN, 1987).

A virtual learning community focused on the organized sharing of teachers' own pedagogical creations could fill that gap and motivate them. A study based on social network analysis of the long-lasting IRIS virtual learning community within the Tianhe Blog for teachers has highlighted important features of effective virtual learning communities (LIN et al, 2014). The presence of key individuals with strong academic backgrounds that had important roles in sharing resources and guiding collaborations was shown to be of pivotal importance for the virtual learning community integration. The sample in virtual learning communities Lin et al (2014) comprised a total of 188 subjects who gradually joined the virtual learning community along ten years, whilst in the present study, 750 individuals joined the VLC-Bio nearly simultaneously in five short intervals during two years. In the case of the VLC-Bio it is thus possible that the great number of participants who joined the community for such short time may have prevented the establishment of the sort of structured connections necessary for the consolidation of collaborative groups (MATZAT, 2013). Lin et al (2014) also showed that the existence of a face-to-face network connecting some members of the associated online collaborative network was important for the whole community integration virtual learning communities (LIN et al, 2014). That finding corroborated an early work based on surveys sent to members of blended teachers' communities (MATZAT, 2013) and was again recently reinforced by Zhang et al (2017).

As far as can be inferred from our data, the VLC-Bio members did not join face-to-face networks, something that could have contributed to the consolidation of the VLC-Bio itself. It is known that a virtual learning community can originate from preexisting face-to-face communities. On the other hand, a virtual learning community can lead its members to later develop face-to-face communities. It remains unknown which factors could lead a community established exclusively online to remain active as such for long periods. An early experience using Twitter showed that faculty and students may remain in contact even after the initial task is concluded, suggesting that the choice of the adequate tool may play a role in establishing long-term connections (DUNLAP; LOWENTHAL, 2009). But that study also included face-to-face interactions among group members in its early stages (DUNLAP; LOWENTHAL, 2009). Finally, as can be inferred by a recent review on virtual learning communities aimed at teachers (MACIA; GARCIA, 2016), most studies report the total numbers of participants in a given moment but few, if any, describe the dynamics of joining and abandonment of such communities. As our result show, total numbers may vary consistently over time, suggesting that studies should pay closer attention to variations of members and their putative causes.

The alternation of high participation followed by underutilization of the VLC-Bio point to the potential limitation of virtual learning communities as permanent strategies for teachers' professional development in Brazil. Indeed, as the commitment to the C-OPDP ended, the access to virtual learning community

declined steeply only to increase again during the next courses. It seems thus reasonable to conclude that is similar in structure to the VLC-Bio are unlikely to evolve into autonomous spaces of professional development for teachers regardless of the positive perceptions of their prior participation in such communities.

5. Limitations and perspectives

The present study has limitations concerning the size and the composition of the sample of teachers that answered the questionnaire. The response ratio was small, even for studies on distance education. The sample was also biased towards returning teachers, as they represented 55.6% of the responders but the majority of teachers are unlikely to have returned to the VLC-Bio after the closure of their courses. We believe that those limitations are somewhat counterbalanced by the quality of the results yielded by that sample. Such rationale is similar to that of Martinovic and Zhang (2012) who also obtained very low response rates (8.7%) but highlighted the qualitatively relevant insights provided by their respondents. Indeed, although the non-returning teachers were underrepresented in our sample, it is noteworthy that many of them took a portion of their scarce free time to anonymously and voluntarily answer a questionnaire concerning a virtual community of which they were no longer members. Moreover, the fact that the majority of the non-returning teachers' answers concerning their reasons to abandon the VLC-Bio grouped within a single major category corroborates the idea that the lack of free time is likely a major cause contributing to the teachers' decision not to return. The present study is based on the teachers' self-assessment, which is prone to perception bias. However, coherent justifications were provided by most of the teachers for most of their answers. The majority of the responders also answered the open question. Both factors reinforced data that showed consistency with their responses to each assertion and allowed further discussion of their meanings.

Several authors suggested that the use of virtual learning communities is one of the main strategies to improve teacher professional development programs (BORGES; NICHELE; MENEZES, 2016, BRANSFORD, BROWN; COCKING, 2000, DARLING-HAMMOND; BRANSFORD, 2005, DEDE et al, 2008, OZKAN; MCKENZIE, 2008). According to Allan and Lewis (2006), engaging in a virtual learning community can change individuals' perspectives, leading them to learn new subjects and even culminating in career changes. When interacting with their peers, teachers are able to effectively reflect on different teaching techniques, choosing to adopt them or not. Thus, professional development programs that promote acquisition of collaborative skills have proven the most effective (WILSON, 2012), creating learning and professional development opportunities (NATIONAL RESEARCH COUNCIL, 2007, WANG; LU, 2012). As stressed by other authors, teacher professional development initiatives may have a limited impact when only a minor fraction of the teachers is reached (EL-HANI; GRECA, 2013).

Strategies to reach a greater number of teachers are thus needed. Evidences found in the present study show that factors other than repeated actions to attract users to specific collaborative environments are necessary to create an exclusively online virtual learning community for teachers. For instance, the invitation of a great number of Biology teachers to join nearly simultaneously the same virtual learning community seems not to be an effective strategy to start an autonomous and active community, despite their active participation in early stages of such a community. External factors, such as lack of time, are still strong enough to break the connections created during the use of the VLC-Bio associated with online professional development courses. In the future, it would be important to further investigate if and how a virtual learning community exclusively managed by the teachers themselves could be consolidated. That approach is relevant because face-to-face connections may often be impossible for teachers that are under the strain of a heavy work load and are geographically dispersed in large countries with limited resources to invest in teachers' development such as Brazil.

References

- ALLAN, B.; LEWIS, D. The Impact of Membership of a Virtual Learning Community on Individual Learning Careers and Professional Identity. **British Journal of Educational Technology**, v. 37, n. 6, p. 841–852, 2006. [doi: 10.1111/j.1467-8535.2006.00661](https://doi.org/10.1111/j.1467-8535.2006.00661).
- BALLET, K.; KELCHTERMANS, G. Struggling with Workload: Primary Teachers' Experience of Intensification. **Teaching and Teacher Education**, v. 25, n. 8, p. 1150–1157, 2009. [doi: 10.1016/j.tate.2009.02.012](https://doi.org/10.1016/j.tate.2009.02.012)
- BORGES, K. S.; NICHELE, A. G.; MENEZES, C. S. Formação Continuada de Professores Através de Comunidades de Prática: um Estudo de Caso. **Revista Brasileira de Informática na Educação**, v. 24, n. 2, p. 13, 2016. [doi: 10.5753/rbie.2016.24.02.13](https://doi.org/10.5753/rbie.2016.24.02.13)
- BOYD, D. M.; ELLISON, N. B. Social Network Sites: Definition, History, and Scholarship. **Journal of Computer-Mediated Communication**, v. 13, n. 1, p. 210–230, 2008. [doi: 10.1111/j.1083-6101.2007.00393](https://doi.org/10.1111/j.1083-6101.2007.00393).
- BRANSFORD, J. D.; BROWN, A. L.; COCKING, R. R. **How People Learn: Brain, Mind, Experience, and School** (Expanded E., p. 384). Washington, D.C.: National research Council, 2000.
- BRAZIL. **Orientações Curriculares para o Ensino Médio: Ciências da Natureza, Matemática e suas Tecnologias** (Vol. 2, p. 140). Brasília, DF: Secretaria de Educação Média e Tecnológica/MEC, ISBN 85-98171-43-3. 2006.
- BROWN, C. A.; NEAL, R. E. W. Definition and History of Online Professional Development. In J. KEENGWE; L. KYEI-BLANKSON (Eds.), **Virtual Mentoring for Teachers: Online Professional Development Practices** (pp. 182–184). IGI-Global. 2013. [doi: 10.4018/978-1-4666-1963-0.ch010](https://doi.org/10.4018/978-1-4666-1963-0.ch010)
- CONAE. **Construindo o Sistema Nacional Articulado de Educação: o Plano Nacional de Educação, Diretrizes e Estratégias; documento final**. Brasília: INEP. Brasília, DF. 2010.
- DARLING-HAMMOND, L.; BRANSFORD, J. (EDS.). **Preparing Teachers for a Changing World: What Teachers Should Learn and Be Able to Do** (p.583). San Francisco, CA: Jossey-Bass Inc, 2005.
- DEDE, C. et al. A Research Agenda for Online Teacher Professional Development. **Journal of Teacher Education**, v. 60, n. 1, p. 8–19, 2008. [doi: 10.1177/0022487108327554](https://doi.org/10.1177/0022487108327554)
- DUNLAP, J. C.; LOWENTHAL, P. R. Tweeting the Night Away: Using Twitter to Enhance Social Presence. **Journal of Information Systems Education**, v. 20, n. 2, p. 129–136, 2009.
- EL-HANI, C.; GRECA, I. ComPratica: A Virtual Community of Practice for Promoting Biology Teachers' Professional Development in Brazil. **Research in Science Education**, v. 43, p. 1327–1359, 2013. [doi: 10.1007/s11165-012-9306-1](https://doi.org/10.1007/s11165-012-9306-1)
- FRAENKEL, J.; WALLEEN, N. **How to Design and Evaluate Research in Education** (7th ed.). New York: McGraw-Hill, 2008.
- GLASSMAN, M.; KANG, M. J. Intelligence in the Internet Age: The Emergence and Evolution of Open Source Intelligence (OSINT). **Computers in Human Behavior**, v. 28, n. 2, p. 673–682, 2012. [doi:10.1016/j.chb.2011.11.014](https://doi.org/10.1016/j.chb.2011.11.014)
- HUTCHISON, A.; COLWELL, J. Using a Wiki to Facilitate an Online Professional Learning Community for Induction and Mentoring Teachers. **Education and Information Technologies**, v. 17, n. 3, p. 273–289, 2011. [doi:10.1007/s10639-011-9159-7](https://doi.org/10.1007/s10639-011-9159-7)
- KAO, C.-P.; TSAI, C.-C. Teachers' Attitudes Toward Web-Based Professional Development, with Relation to Internet Self-Efficacy and Beliefs About Web-Based Learning. **Computers & Education**, v. 53, n. 1, p. 66–73, 2009. [doi:10.1016/j.compedu.2008.12.019](https://doi.org/10.1016/j.compedu.2008.12.019)

- KAO, C.-P.; WU, Y.-T.; TSAI, C.-C. Elementary School Teachers' Motivation Toward Web-Based Professional Development, and the Relationship with Internet Self-Efficacy and Belief About Web-Based Learning. **Teaching and Teacher Education**, v. 27, n. 2, p. 406–415, 2011. [doi:10.1016/j.tate.2010.09.010](https://doi.org/10.1016/j.tate.2010.09.010)
- KLING, R.; COURTRIGHT, C. Group Behavior and Learning in Electronic Forums: A Sociotechnical Approach. **The Information Society**, v. 19, n. 3, p. 221–235, 2003. [doi:10.1080/01972240390210055](https://doi.org/10.1080/01972240390210055)
- LIN, X. et al. A Social Network Analysis of Teaching and Research Collaboration in a Teachers' Virtual Learning Community. **British Journal of Educational Technology**, v. 47, n. 2, p. 302–319, 2014. [doi: 10.1111/bjet.12234](https://doi.org/10.1111/bjet.12234)
- LUZ, M. R. M. P. et al. Characterization of the Reasons Why Brazilian Science Teachers Drop Out of Online Professional Development Courses. **International Review of Research in Open and Distributed Learning**, v. 19, n. 5, p. 145–164, 2018. [doi:10.19173/irrodl.v19i5.3642](https://doi.org/10.19173/irrodl.v19i5.3642)
- MACIA, M.; GARCIA, I. Informal Online Communities and Networks as a Source of Teacher Professional Development: A Review. **Teaching and Teacher Education**, v. 55, n. 3, p. 291–307, 2016. [doi:10.1016/j.tate.2016.01.021](https://doi.org/10.1016/j.tate.2016.01.021)
- MARTINOVIC, D.; ZHANG, Z. Situating Ict in The Teacher Education Program: Overcoming Challenges, Fulfilling Expectations. **Teaching and Teacher Education**, v. 28, n. 3, p. 461–469, 2012. [doi:10.1016/j.tate.2011.12.001](https://doi.org/10.1016/j.tate.2011.12.001)
- MARTINS, N. H. S. P. et al. Interações Entre Professores e Licenciandos de Ciências Biológicas. In **X Encontro Nacional de Pesquisa em Educação em Ciências** (pp. 1–8). Águas de Lindóia, SP, 2015. Acessado em 15/04/2016. Disponível em http://www.xenpec.com.br/anais2015/lista_area_18.htm
- MATZAT, U. Do blended virtual learning communities enhance teachers' professional development more than purely virtual ones? A large scale empirical comparison. **Computers & Education**, v. 60, n. 1, p. 40–51, 2013. [doi: 10.1016/j.compedu.2012.08.006](https://doi.org/10.1016/j.compedu.2012.08.006)
- NATIONAL RESEARCH COUNCIL. **Enhancing Professional Development for Teachers: Potential Uses of Information Technology, Report of a Workshop**. Washington, D.C: The National Academic Press, 2007.
- OECD. **PISA 2009 Results: What Students Know and Can Do – Student Performance in Reading, Mathematics and Science** (Volume I) (Vol. I). Paris, France: OECD Publishing, 2010. [doi: 10.1787/9789264091450-en](https://doi.org/10.1787/9789264091450-en)
- OZKAN, B.; MCKENZIE, B. Social Networking Tools for Teacher Education. In **Society for Information Technology & Teacher Education International Conference** (Vol. 2008, pp. 2772–2776), 2008. Acessado em 05/10/2012. Disponível em <http://www.editlib.org/p/27640/>
- PARK, J.; CHOI, H. Factors influencing adult learners' decision to drop out or persist in online learning. **Educational Technology & Society**, v. 12, n. 4, p. 207–217, 2009. Acessado em 21/07/2014. Disponível em http://www.ifets.info/others/download_pdf.php?j_id=45&a_id=995
- PARK, J. et al. Colleagues' roles in the professional development of teachers: Results from a research study of National Board certification. **Teaching and Teacher Education**, v. 23, n. 4, p. 368–389, 2007. [doi: 10.1016/j.tate.2006.12.013](https://doi.org/10.1016/j.tate.2006.12.013)
- ROLANDO, L. G. R.; SALVADOR, D. F.; LUZ, M. R. M. P. The use of internet tools for teaching and learning by in-service biology teachers: A survey in Brazil. **Teaching and Teacher Education**, v. 34, p. 46–55, 2013. [doi: 10.1016/j.tate.2013.03.007](https://doi.org/10.1016/j.tate.2013.03.007)

- ROLANDO, L. G. R. et al Learning with their peers: Using a virtual learning community to improve an in-service Biology teacher education program in Brazil. **Teaching and Teacher Education**, v. 44, p. 44–55, 2014. doi: [10.1016/j.tate.2014.07.010](https://doi.org/10.1016/j.tate.2014.07.010)
- SALVADOR, D. F. et al. Um panorama da formação continuada de professores de Biologia e ciências através da ead no estado do rio de Janeiro. **EAD Em Foco**, v.1, p. 59–68, 2010. doi: [10.18264/eadf.v1i1.19](https://doi.org/10.18264/eadf.v1i1.19)
- Salvador, D. F. et al. Comunidade virtual aprendizagem para professores de Biologia – avaliação da utilização e desafios. **Revista Electrónica de Investigación En Educación En Ciencias**, v. 12, n. 1, p. 12–22, 2017. Acessado em 12/03/2018. Disponível em http://www.scielo.org.ar/scielo.php?script=sci_arttext&pid=S1850-66662017000100002
- SHULMAN, L. S. Knowledge and Teaching: Foundations of New Reform. **Harvard Educational Review**, v. 57, n. 1, p. 01–21, 1987.
- TSIOTAKIS, P.; JIMOYIANNIS, A. Critical factors towards analysing teachers' presence in on-line learning communities. **Internet and Higher Education**, v. 28, p. 45–58, 2016. doi: [10.1016/j.iheduc.2015.09.002](https://doi.org/10.1016/j.iheduc.2015.09.002)
- UNESCO. **ICT competency standards for teachers**. United Kingdom, 2008.
- UNESCO. **Unesco ICT competency framework for teachers**. Paris, France, 2011.
- WANG, Q.; LU, Z. A case study of using an online community of practice for teachers' professional development at a secondary school in China. **Learning, Media and Technology**, v. 37, n. 4, p. 429–446, 2012. doi: [10.1080/17439884.2012.685077](https://doi.org/10.1080/17439884.2012.685077)
- WILSON, A. Effective professional development for e-learning: What do the managers think? **British Journal of Educational Technology**, v. 43, n. 6, p. 892–900, 2012. doi: [10.1111/j.1467-8535.2011.01248](https://doi.org/10.1111/j.1467-8535.2011.01248).
- YANG, S. J. H. et al. Enhancing the Quality of e-Learning in Virtual Learning Communities by Finding Quality Learning Content and Trustworthy Collaborators. **Educational Technology & Society**, v. 10, n. 2, p. 84–95, 2007. Acessado em 18/07/2013. Disponível em https://www.j-ets.net/ETS/journals/10_2/8.pdf
- ZHANG, S. et al. Interactive networks and social knowledge construction behavioral patterns in primary school teachers' online collaborative learning activities. **Computers & Education**, v. 104, p. 1–17, 2017. doi: [10.1016/j.compedu.2016.10.011](https://doi.org/10.1016/j.compedu.2016.10.011)

Appendix 1

- I - When taking part of the virtual community, I have learned biology-related contents. Why (not)?
- II - When taking part of the virtual community, I have learned new ways of teaching biology. Why (not)?
- III - When taking part of the virtual community, I have learned to use Internet tools (forum, blog, videos, and images) to learn biology. Why (not)?
- IV - When taking part of the virtual community, I have not felt comfortable to expose my ideas. Why (not)?
- V - When taking part of the virtual community, I have learned to teach Biology using online tools (forum, blog, videos, and images). Why (not)?
- VI - After the end of the course that you have attended in the CECIERJ Foundation, have you participated in the virtual community again? Yes or No. Why (not)?