Kurdish Studies
April 2024
Volume: 12, No: 2, pp. 6417-6424
ISSN: 2051-4883 (Print) | ISSN 2051-4891 (Online)
www.KurdishStudies.net

DOI: 10.53555/ks.v12i2.2857

Talks On Physics Education, A Space Of Dialogical Learning For Professors And Researchers

Ramírez Díaz, Mario Humberto[1*], Escobar Moreno, Fabiola[2], Ruiz Mendoza, Juan Carlos[3]

[1*]Instituto Politécnico Nacional, México
[2]Instituto Politécnico Nacional, México
[3]Universidad Autónoma de Nuevo León, México

***Corresponding Author:** Ramírez Díaz, Mario Humberto
*Instituto Politécnico Nacional, México

Abstract
This article presents the results of an investigation whose objective was to describe an experience of dialogical learning that involved students, graduates, and researchers in a discussion space called "Talks on Physics Education" (TPE), which revolved around the products of inquiries in the framework of the didactics of Physics. In addition, adopting a qualitative focus based on Grounded Theory, our research responds to the question: How are these TPE influeninge dialogical learning (DL) among professors and researchers in the disciplinary field of Physics Education? We conclude that empirical evidence based on the perceptions of the speakers involved reveals a tendency toward the TPE becoming an effective space for dialogical learning on the didactics of Physics.

Keywords: Physics education, teachers training, dialogical learning.

Introduction

Most of the early "Talks on Physics Education" (TPE) took the form of "researcher-to-researcher" collaboration, but they later evolved to function as a community of learning. Emerging from that background, in 2020, a group of eight alumni of the Graduate Program in Physics Education at Mexico's Instituto Politécnico Nacional (IPN) proposed organizing a discussion forum for students and graduates who form part of the community of Physics Education in Latin America to share their research experiences and the results of their investigations in this field in the "TED Talks" format (TED Talks, 2023). As a result, the TPE became increasingly rich, informative discussions as this space for dialogical interaction was opened to participation by a wider public. Indeed, time has shown that one of the strengths of this space for reflection is that it makes it possible for alumni (who are now active researchers) to maintain contact with the community of graduate students (in-training, active professors) and consolidated researchers. In the end, the dissemination of ongoing studies in Physics Education, and this means of communicating their results, has led to the creation of a true community of learning.

To date, four cycles have been completed, each one with 30 talks given by different researchers whose investigations are inserted into distinct areas of the field of Physics Education. The topics most often discussed have been methodologies for learning Physics and the use of educational technologies in teaching this discipline. The TPE that has generated greatest interest among users pertains to the area of the Epistemology of Science, with an emphasis on Physics.

The objective of the present investigation, then, is to describe and analyze, from the perspective of the TPE, whether this forum can be accredited with the components of dialogical learning, based on evaluations by participating researchers of the products of their inquiries in the framework of the didactics of Physics. In accordance with this aim, we seek to respond to the question: how do the TPE influence dialogical learning among professors and researchers in the disciplinary field of Physics Education? In this regard, we consider that the TPE is framed by the principles of dialogical learning; namely, egalitarian dialogue, cultural intelligence, transformation, instrumental dimension, creation of meaning, solidarity, and equality of differences (Aubert, García and Racionero, 2009).

Dialogical learning in Physics

For students and professors alike, the use of dialogue plays a fundamental role in learning Physics. This focus has been amply studied in the literature on Physics Education (Worku and Alemu, 2021, Díez -Palomar and Anagnostopoulou, 2019). Specifically, the field known as Research in Physics Education (RPE) has explored dialogical learning among researchers to analyze the appropriation of knowledge and processes of individual reflection on Physics (Renshaw, 2004). Some researchers have demonstrated the importance of dialogue in learning science, not only among students and professors, but also research peers, as a way to achieve consensus, forge commitments, and promote the divulgation of the results of RPE (Sfard, 2019). The "dialogical method" has long been utilized as a pedagogical option in science (Shor and Freire, 1987), even at academic events (AAPT, ICPE, GIREP, among others), where it is the principal activity that attendees develop as they share the results of their investigations and their opinions and commentaries regarding the findings of others. It is important to specify that dialogical learning is based on solid, broad, important, scientific, and theoretical constructs which reveal this kind of learning as a motor of social transformation, under the following premise: "…all people can make significant

contributions to teaching-learning processes (through cultural intelligence) and, in turn, all will benefit from the communicative processes so developed" (Álvarez Álvarez, González Cotado, & Larrinaga Iturriaga, 2013).
One condition for achieving DL consists in creating forums for collective learning, where peers come together to share and discuss ideas, results, and opinions; that is, events that function as anterooms for cognitive evolution (de la Garza, Slade, Lafortune, Pallascio, & Mongeau, 2003). This article presents the results of the creation of a community of alumni and current students in the Graduate Program in Physics Education in Mexico formed through the "TED Talks" format. This community is denominated "Talks on Physics Education", and it functions as a forum for disseminating the results of research and participants' varied experiences while conducting RPE.

Program in Physics Education at the IPN

As mentioned above, the context of this investigation is a Graduate Program in Physics Education. In 2005, the "International Year of Physics", Mexico's IPN proposed a graduate program in Physics Education designed to satisfy the training needs of the broad sector of Physics professors at the national level in two principal areas: professional development, and formation as researchers. For Physics professors, the program provides entry into a community of colleagues with common interests, shared problems, and diverse experiences. This corpus of varied empirical knowledges is one of the sources of scholarship from which the course sets out to advance toward systematic reflections on educational processes, since participants are active professors with abilities and practical knowledge that they have striven to perfect through years of teaching (Ramírez, 2017).
The program is offered online on the Moodle platform, so students from around the world can study for a Master's or Doctoral degree in Physics Education. The program began in 2006, and 16 years later we have students from the United States, Mexico, Costa Rica, Honduras, Panama, Colombia, Ecuador, Chile, the Dominican Republic, Surinam, Uruguay, Spain, Iran, and Angola. Despite the large number of graduates from different countries, contact and collaboration among them over the years has resulted in only a few publications, most of them elaborated with their advisers while they were still students. But that contact, unfortunately, often lapsed once they graduated. The main reason that alumni mention for this is their lack of knowledge about "what other graduates investigate after completing the program". This comment reflects the absence of a "community of researchers in Physics Education" that could include graduates from the program.
Animated by this obvious need, a group of doctoral students proposed creating a space where members of the program's community could share their research projects and results, as well as project proposals, and discuss them with future colleagues and professors from the program. Once implemented, their proposal received a good response. In this article, we present and discuss the results of our analysis of their encounters, denominated "Talks on Physics Education", and their usefulness in creating a virtual learning community in Physics Education.

Research Methodology

General Background

The framework of this study can best be described as a qualitative inquiry of the Grounded Theory type (GT), a focus that is appropriate when interest lies in determining how actors in a given situation interpret their reality (Suddaby, 2006). The inquiry thus analyzes the perceptions and experiences of the actors involved in the TPE, since GT is, by nature, interpretative. While other theoretical frameworks exist to analyze the interaction among experts in a certain discipline, such as Ordinary and Extraordinary Science as Thomas S. Kuhn's proposed in his book The Structure of Scientific Revolutions (Kuhn, 2019), the objective of our approach is to discover new ways to understand the processes of learning or unlearning, and then implement them (authors' note) through dialogue mediated by the genuine, spontaneous generation of ideas in a natural environment, like the one that the TPE provides (Salgado, 2007).
The units of analysis are the TPE. To make the relevant information perceptible, an instrument was designed based on an ordered, unidimensional Likert-type scale, purposely of emergent design, to understand and reflect in-depth on the dialogical learning generated during the TPE. All the talks given to date are available for viewing in the YouTube Physics Education Program (Physics Education IPN).
To complement this approach, we adopted the case study method, an approach often used in educational research and studies of one sole educational entity (Bisquerra, 2009). Case studies can focus on a class, a specific topic, or a dynamic used by a certain professor, among other possibilities. It is a focus well-adapted to small-scale, short-term, clearly delimited studies and interventions. The case study presented here is descriptive because our interest lay in describing and analyzing the following key aspects:
1) Egalitarian dialogue
2) Transformation
3) Cultural intelligence
4) Instrumental dimension
5) Creation of meaning
6) Solidarity
7) Equality of differences
These descriptors are explained in detail in the following section.

Talks on Physics Education (TPE)

As mentioned at the outset, the Graduate Program in Physics Education at the IPN was created in 2006 as a necessary element for training researchers in the learning of Physics in Mexico. It was the first of its kind in the country. The first graduates from both the Master's and Ph.D. programs received their degrees in 2009. Since then, this community of Physics

professors has grown by incorporating graduates from Mexico, Colombia, Ecuador, Chile, Costa Rica, the U.S.A., Honduras, Iran, and Angola, as well as through collaboration with research groups in Physics Education worldwide, especially in Latin America. Early on, most of this collaboration was of the "researcher-to-researcher" type, so the circle did not yet function as a community of learning. But based on these antecedents, in the year 2020, a group of graduates from the IPN's program proposed organizing a seminar directed to the students and graduates who make up the community of Physics Education in Mexico so they could share their investigations and research experiences in Physics Education in the "TED-Talks" format. The original group was made up of 8 Doctors in Physics Education from Mexico, Colombia, and Chile, all of them graduates of the Program. The initial objectives were to share experiences related to the question, what is Physics Education? and to gather information on projects currently being developed by members of the community of graduates from the program.

Sessions originally took place in the "Talks among Peers" format, for there was no pretension of serving as a forum or formal congress. Each event began with an introductory talk by a member of the community on a specific topic, followed by open discussion by the attendees. There was no expectation of reaching formal conclusions on the theme addressed. In its first "season", the group held a closed cycle of 8 talks (titles and speakers are listed in Table 1) among the original members of the community, transmitted remotely on the Zoom platform, and taped for open reproduction on the Graduate School's YouTube channel. The format was (and continues to be) based on a 15–20-minute introduction to the topic by a member of the community who is an expert in the area, followed by an open discussion for 40 minutes in which all attendees are free to participate, express their opinions, ask questions, and refute arguments and proposals related to the topic.

In the following "season", the community decided to "open" the exercise to a wider public, though it was still organized specifically for students and graduates from the program. The idea behind this change was to "consolidate" the format. While remote transmission over the Zoom platform continued, the organizers added live transmission on YouTube Live with the goal of achieving broader diffusion. For the third "season", the community agreed on three significant changes: (i) at least one talk would be given by a Graduate School professor (though not all the professors involved are necessarily graduates, they are all considered active members of the community); (ii) at least one other talk would be given in English (up to that point, all talks had been presented in Spanish); and (iii) one talk would address a topic, but without a specific professor giving the introduction.

Attendees and speakers

In the first season, all sessions were held in a closed format, so only 8 professors participated in each one. They were from the IPN (Mexico), the Universidad Autónoma de San Luis Potosí (Mexico), the Universidad Politécnica de San Luis Potosí (Mexico), the Universidad de Guadalajara (Mexico), the University of Colorado (U.S.A.), the Universidad de la Sabana (Colombia), the Universidad Autónoma de Colombia (Colombia), and Universidad Austral de Chile (Chile). Table 1 shows the titles, speakers' names, and number of reproductions to date on YouTube. For the second season, participation was "open" to the public, though still oriented specifically to the community of graduates in Physics Education. Participation was maintained at an average of 20 attendees during the 8 sessions held that season. Table 1 also shows the topics addressed and the number of reproductions on YouTube.

In season 3, only sessions were held due to the circumstances caused by the COVID-19 pandemic, which impeded completing the 8 that were originally programmed. However, organizers succeeded in having two of the talks take place in the context of the Annual Meeting of the AAPT-MX 2020 at the Universidad de Guadalajara; precisely the two that included the changes agreed upon by the community: a talk in English by Dr. Azita Sayed Fadaei (Iran), and a roundtable discussion of "Educational Technology for the Teaching-Learning of Physics". Those two sessions were attended by over 50 interested people, while the other five maintained an average attendance of 20.

The fourth and fifth seasons have been completed, each with 8 talks, including one in English and a roundtable discussion (on "Epistemology in Physics" in season 4, and on "Active Learning of Physics" in season 5), attended by members of the community from several countries, including Colombia, Ecuador, Chile, Costa Rica, the U.S.A., Honduras, Panama, and Japan.

Table 1. Speakers and topics of the TPE, seasons 1-3.

TPE		
Season	Number of talks	**Speaker (academic formation); topic; number of reproductions**
1	8	1. MHRD (Ph.D., Physics Education); formation: Theoretical Physicist (IPN-Mexico), "What is Physics Education?", 143 reproductions 2. OSJ (Ph.D., Physics Education); formation: Physicist with B.Sc. in Physics Education, (Universidad Autónoma de Colombia), "Physics and Motivation", 111 reproductions 3. SZM (Ph.D., Physics Education); formation: Theoretical Physicist (Universidad Autónoma de San Luís Potosí, Mexico), "Evaluation of the project-based learning methodology through experimental prototypes", 84 reproductions 4. DBLT (Ph.D., Advanced Technology); formation: Theoretical Physicist (University of Colorado, U.S.A.),

		"Projects for the formation of professors and design of didactic material", 61 reproductions 5. DFBR (Ph.D., Physics Education); formation: B.Sc., Physics Education (Universidad de La Sabana, Colombia), "Virtual laboratory simulations and Applets in the teaching of the natural sciences", 64 reproductions 6. JAMP (Ph.D., Physics Education); formation: B.Sc., Physics Education (Universidad Austral de Chile), "Evaluation of the teaching profession", 37 reproductions 7. CAS (Ph.D., Physics Education); formation: Theoretical Physicist (Universidad Politécnica de San Luís Potosí, Mexico), "Toward a horizon in the actualization of Physics professors", 41 reproductions 8. JLSF (Ph.D., Physics Education); formation: Mathematician (Universidad de Guadalajara), "Evaluation in the teaching of Physics", 80 reproductions
2	8	1. JGCM (Ph.D., Philosophy of Science); formation: Theoretical Physicist and Philosopher (IPN-Mexico), "Epistemology of the sciences", 255 reproductions 2. JMPC (M.Sc., Physics Education); formation: Theoretical Physicist (Universidad Veracruzana, Mexico), "The popularization of science", 121 reproductions. 3. LHB (Ph.D., Educational Physics); formation: B.Sc., Physics Education (Universidad Central de Colombia), "Learning Bernoulli's equation with engineering students utilizing PODS and discrepant experiments",)4 reproductions 4. LHC (Ph.D., Educational Physics); formation: B.Sc., Physics Education (Universidad de Santiago de Chile), "Previous ideas in astronomy", 89 reproductions 5. SGMG (Ph.D., Physics Education); formation: Theoretical Physicist (IPN-Mexico), "Didactic design for learning Physics", 72 reproductions 6. FEM (Ph.D., Physics Education); formation: Chemical Engineer (IPN-Mexico), "The contextualization of Physics in engineering; promoting pertinent, coherent learning", 50 reproductions 7. OJS (Ph.D., Physics Education); formation: B.Sc., Physics Education (Universidad Autónoma de Colombia). "Academic and work-related stress", 84 reproductions 8. MSM (Ph.D., Physics Education); formation: Physicist (Universidad Politécnica del Golfo, Mexico), "Problem-based learning and Web taxonomy", 50 reproductions.
3	7	1. JAFC (Ph.D., Systems Engineering); formation: Electrical Engineer (IPN-Mexico), "New Technologies in teaching Physics", 75 reproductions 2. OJS (Ph.D., Physics Education); formation: B.Sc., Physics Education (Universidad Autónoma de Colombia), "Academic stress in Physics professors and students", 87 reproductions 3. MERP (Ph.D., Behavioral Science); formation, Chemical Engineer (Universidad de Guadalajara, Mexico), "Perceptions on Physics Education among students, professors, and employees in Jalisco", 63 reproductions 4. MCN (Ph.D., Physics Education); formation: Mechanical Engineer (Universidad Autónoma del Estado de Hidalgo, Mexico), "Characterization of thought in Physics: some reflections", 76 reproductions 5. MSAA (Ph.D., Physics Education); formation: B.Sc., Physics Education (Escuela Superior Politécnica del Litoral del Ecuador), "Alternative conceptions and their importance in the teaching of Physics", 49 reproductions

		6. ASF (Ph.D., Physics Education); formation: Theoretical Physicist (College of Seattle, U.S.A.), "Comparison of the effects of laboratory activities based, and not based, on recipe books in an active learning environment", 70 reproductions 7. Roundtable, "Educational technology for teaching-learning in Physics", 75 reproductions

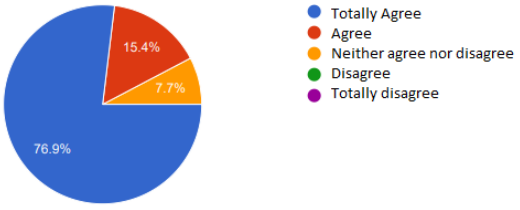
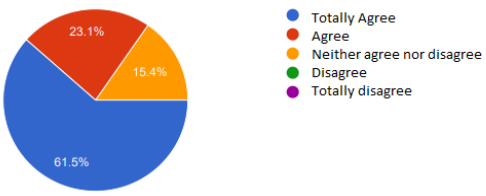
Research Results

While the questions and comments generated during these TPE focused largely on the topic proposed for the respective session, participants were free to add observations on links to other lines of research in Physics Education. For example, attendees might relate personal experiences and comments from their own research to enrich the talk. The objective of the TPE has always been to disseminate studies and research conducted by community members, most of whom are Physics professors in different levels of the educational system (from preschool to graduate programs), accompanied by students and graduates of the program in Physics Education. Thus, in a first moment, participants can share their experiences and perceptions on the topics addressed, then, in a second moment, discuss the key elements of the talk that they consider useful for their teaching practice and research. This aspect is important because, while the vast majority of the speakers (almost)1%) are Educational Physicists, around 60% received training at the undergraduate level in the factual sciences. Likewise, the academic formation of those with a B.Sc. in Physics Education shows that 60% studied the factual sciences, while the remaining 40% earned degrees in some area of the pedagogical sciences. Clearly, this background eventually comes to influence both their research interests and their discourse.

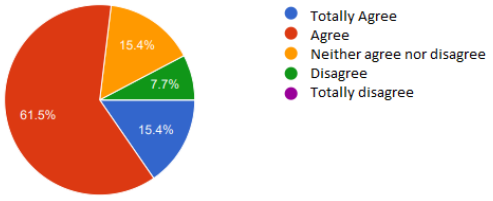
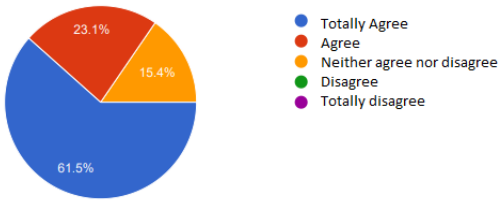
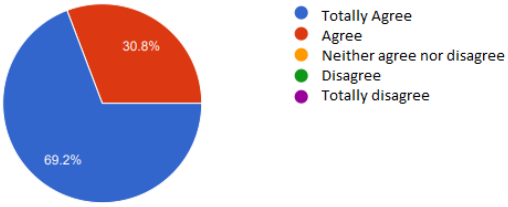
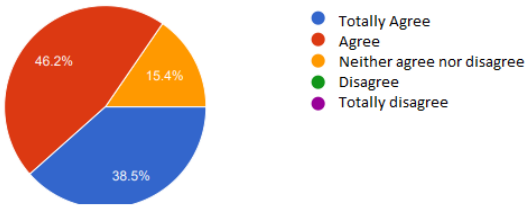
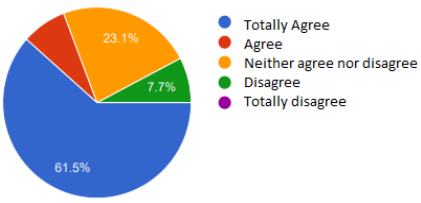
As mentioned above, a Likert-type instrument was utilized to study the seven descriptors of dialogical learning. The positive values on the scale included "0" (Elejabarrieta & Iñiguez, 2008). The numbers were given the following meanings: Totally agree (2); Agree (1); and Neither agree nor disagree (0); while the negative values were: Disagree (-1); and Totally disagree (-2). The graphs in Table 2 are derived from the information gathered utilizing this instrument, which consisted in 12 items that are congruent with the axiomatic characteristics of dialogical learning outlined above. The content of the instrument was validated by peers (two Doctors in Physics Education and a Doctor in the Philosophy of Science). The instrument was applied to the TPE speakers between January and March 2021 using Google Forms [GF] survey administrator software. The results based on the application of the instrument and the characteristics of DL are shown in Table 2. The detailed analysis of results is presented in Table 3.

We should clarify that, in order to maintain harmony with the GT and adequately analyze perceptions and experiences – since the ideas involved are not completely structured– we examined the speakers' ideas by focusing on the lexicon they employed as part of a one-variable qualitative discourse analysis; that is, the lexicon of the disciplinary field. Hence, the analysis was performed considering only the responses to question), utilizing the Word Frequency Counter function[1] to total the number of times each key word appeared. We found that the lexicon utilized was basic, but that certain technicisms and concepts were discussed quite broadly during participation by the attendees. This made conceptual construction or modification possible and revealed the implications of the teaching of Physics and research in this discipline of Physics Education, after the TPE.

Table 2. Responses to the instrument on the analysis of the TPE.

Statement	Result
The TPE in which you participated fulfilled its purpose; that is, a conference in an agreeable academic atmosphere without traditional formalities.	 **Figure 1**. Graph for question 4.
The TPE forum helps professors reflect on ways to improve their teaching practice, research skills, and introspection, and helps reduce drop-out rates related to the learning of Physics.	 **Figure 2**. Graph for question 5.

[1] https://key-content.com/es/contador-frecuencia-palabras/

Difficulties in the interaction between teaching and research reflect a complicated convergence of professors' practical demands, theoretical concerns, and the search for foundations by researchers.	 **Figure 3**. Graph for question 6.
The TPE in which you participated were marked by cooperative discussion among all participants, including yourself.	 **Figure 4**. Graph for question 7.
The TPE was of interest to the professors for understanding, interpreting, appropriating, and using the results of your research.	 **Figure 5**. Graph for question 8.
Why?	Words most often uttered and their frequency: professor, 5 Physics, 5 didactics, 4 research, 4 exchange, 3 experts, 3 feedback, 2 collaboration, 2 classroom, 2
The questions, reflections, or comments of other participants allowed you to see your own work from another perspective and detect new problems for your line of research.	 **Figure 6**. Graph for question 10.
It is necessary to include people from a wider community; that is, open the TPE to all kinds of public.	 **Figure 7**. Graph for question 11.
Why?	Some responses: a) Because the topics addressed are of general interest, and the talks allow the divulgation of knowledge and exchanges of different points of view. b) The talks are enriched by the opinions of the whole community on specific research topics with the vision, experience, and opinions of students and researchers from other areas of research (in the field of Physics Education but not exclusively) that can contribute to one's own. c) It might be better to elaborate works that emanate from the

talks for a wider public. Though I feel the conversations are conducted with less formality than at conferences or expositions, they still use some technical language that could make the exercise tedious for people who are not oriented in our discipline… or perhaps [it would be good to] create a version oriented more toward divulgation than diffusion.
d) It could be interesting to convert it into an open forum for Physics professors, even if they're not graduate students, but I'm not sure if it's a good idea to open it to the public.
e) It could disseminate the importance of Physics Education to enrich other disciplines.
f) Professors in other areas are also interested in improving their teaching, because it would give access to a different perspective on the work performed in the discipline.
g) Why is it necessary to disseminate the results of research to make them useful? I understand that the Talks are divulgation events (communication among peers).
h) Making them accessible to the public (diffusion event) would mean renouncing the specialized tone and translating the foundations into metaphors that the public could understand.
i) Because we need to diversify the profiles of participants who can contribute.
j) Access to knowledge should be open to the entire society.
k) It's a compass to determine if the consultations are clear, pertinent, and applicable in the classroom.
l) It can't be for all publics because the format is for specialists.

Source: elaborated by the authors.

Table 3. Analysis of participants' responses.

Statement on the instrument	Elements of dialogical learning	Justification of results
4	Equality of dialogue	According to Figure 1, 100% of the researchers evaluated this item positively, indicating that contributions were assessed as a function of their argumentative validity.
5	Transformation	According to Figure 2, 100% of the researchers evaluated this item positively, indicating that participants were viewed as agents of change in the teaching of Physics.
6	Cultural intelligence	Most of the researchers (92.3%, see Figure 3) evaluated this item positively, so during the discussions it was possible to reach agreements through dialogue.
7	Instrumental dimension	According to Figure 4, 100% of the researchers evaluated this item positively, so the Talks were marked by rational, bidirectional dialogue.
8	Creation of meaning	According to Figure 5, 100% of the researchers evaluated this item positively, so they understood professors' needs in the classroom setting.
10	Solidarity	According to Figure 6, 100% of the researchers evaluated this item positively, so they understood democratic educational practices.
11	Equality of differences	Most of the researchers (92.3%, see Figure 7) evaluated this item positively, so they value diversity in the opinions and thoughts of others.

Source: elaborated by the authors

Conclusions and Implications

The results derived from the GT and the speakers' positive evaluation provide empirical evidence that the TPE gradually evolved into a space for dialogical learning that has the potential to become a permanent fixture, if developed effectively, in relation to the discipline of Physics and its associated didactics. The TPE take place in a dynamic format, so in each season members evaluate the exercise and propose improvements regarding format, content, and invitees. Members consider that this influences the interests of the consumers of the ideas that derive from the Talks, an aspect that can be quantified based on the number of reproductions, as explained in section 2.2. As with any exercise, the TPE has areas of opportunity, one of

the principal ones detected herein is that they may have "overemphasized" certain topics (e.g., learning methodologies and technology), while leaving others largely unattended (e.g., philosophy and history of Physics, divulgation of science).
In relation to the strengths of the TPE, the study shows that they provide spaces to reflect on areas for improvement in each researcher's own work and to identify needs related to inquiry in the classroom context. At the same time, they help identify limitations and potentialities for educational research in Physics based on distinct economic, political, and social contexts thanks to the diverse nationalities of the speakers and participants. These characteristics are indicative of a collective learning experience that helps develop communicative abilities (counterarguments, opinions), while also encouraging reflections on, and analyses of, educational phenomena from various angles. In addition, dialogue among peers makes it possible to express concrete manifestation of thoughts, an essential process for cognitive evolution. This aspect is accredited and materialized in participants' recognition that the TPE foster dialogical learning; that is, according to their perceptions, argumentation is based on validity, rational, bidirectional dialogue is fomented, there is respect for diversity of thought and opinion, agreements are reached through dialogue, and attendees are conceived as agents of change.
Finally, the greatest strength of the TPE consists in the fact that they allow alumni (who are now active researchers themselves) to stay in contact with the community of graduates by presenting their research in Physics Education and sharing their results, thus leading to the creation of a community.

References

1. Álvarez Álvarez, C., González Cotado, L., & Larrinaga Iturriaga, A. (2013). Aprendizaje dialógico: una apuesta de centro educativo para la inclusión. *Tabanque: revista pedagógica*, (26), 209-224.
2. Aubert, A., García, C. and Racionero, S. (2009). Aprendizaje dialógico. *Cultura y Educación,* **21** (2), 129-139, https://doi:10.1174/113564009788345826
3. Bisquerra, R. (Coord.) (2009). *Metodología de la Investigación Educativa.* Editorial La Muralla, Madrid.
4. de la Garza, D., Slade, M., Lafortune, C., Pallascio, L. & Mongeau, P. (2003). ¿Qué es el pensamiento dialógico crítico? *Perfiles educativos*, *25*(102), 22-39.
5. Díez -Palomar, J. and Anagnostopoulou, E. (2019). Reuniones dialógicas de matemáticas y física: fomento del pensamiento crítico entre estudiantes adultos. In *Undécimo Congreso de la Sociedad Europea para la Investigación en Educación Matemática.* Grupo Freudenthal; Instituto Freudenthal; ERME.
6. Elejabarrieta, F. & Iñiguez, L. (2008). Construcción de escalas de actitud tipo Thurstone y Likert. *Revista electrónica La sociología en sus escenarios*. Centro de Estudios de Opinión, Universidad de Antioquia.
7. Kuhn, T. (2019). *La estructura de las revoluciones científicas*. Fondo de cultura económica, (2019).
8. Ramírez, M. (2017). Clases interactivas demostrativas en la formación docente en línea. *Revista de Educación a Distancia,* **55** (3), 1-20.
9. Renshaw, Peter D. (2004). Aprendizaje, enseñanza e instrucción dialógica. *Aprendizaje dialógico.* Springer, Dordrecht, 1-15.
10. Salgado, A. (2007). Investigación cualitativa: diseños, evaluación del rigor metodológico y retos. *Liberabit*, *13*(13), 71-78.
11. Sfard, A. Aprendizaje, defectos discursivos y compromiso dialógico. *El manual internacional de Routledge de investigación sobre educación dialógica.* Routledge, 89-99, (2019).
12. Shor, I. and Freire, P. (1987) ¿Qué es el "método dialógico" de enseñanza? *Revista de educación,* **169** (3), 11-31.
13. Suddaby, R. (2006). De los editores: Lo que no es teoría fundamentada. *The Academy of Management Journal,* **49** (4), 633-642.
14. TED Talks (2023). TED Talks Usage Policy, https://www.ted.com/about/our-organization/our-policies-terms/ted-talks-usage-policy
15. Worku, H., & Alemu, M. (2021). Supportiveness of Existing Classroom Culture to the Implementation of Dialogic Teaching: Analysis of Teacher-Student Interaction in Physics Teaching and Learning. *Pedagogical Research*, *6*(3), em0100.

Mario Humberto Ramírez Díaz (corresponding author)	Dr. Titular professor, IPN, Legaria 694, México City. E-mail: mramirezd@ipn.mx ORCID: https://orcid.org/0000-0002-3459-2927
Fabiola Escobar Moreno	Dr. Asociate professor, IPN, Legaria 694, México City. E-mail: fescobar@ipn.mx ORCID: https://orcid.org/0000-0001-8958-2075