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The MENED Program at Nanotechnology Council: A Way to Rapidly Develop Skills and Reach a High Level of Success

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Abstract—IEEE is made up of people. People participation and interaction are crucial to IEEE. After the recent pandemic crisis, IEEE is facing several challenges related to the Young Professionals' (YPs) engagement, commitment, and participation. YPs are key members for developing a sustainable network and for finding the next-generation of IEEE leaders. For societies and councils, it is fundamental to tackle this problem and plan suitable actions to outreach, empower and educate YPs. To this aim, the Nanotechnology Council (NTC) promoted a specific mentoring program called MENED (MENtoring program – from Effectiveness to Durability). MENED aims to involve more YPs in NTC activities, while training and mentoring young professionals of how to contribute to the NTC through the NTC technical committees (TCs). MENED will also increase the number on trained NTC volunteers and help in the development of future generations of NTC leaders. In this work, after almost a year of the project, we report on the MENED experience, while analyzing its output both qualitatively and quantitatively. We present the candidate selection methodology, the first training session, and a thorough analysis of the survey of candidates and technical committees. The idea, methodologies and results of the MENED experience are of great interest to the NTC community but can also be beneficial to the whole IEEE community inspiring and fostering the YPs' involvement.

Index Terms—Education, Innovation, Knowledge and experience transfer, Nanotechnology, networking, experience sharing, teamwork, personal satisfaction

I. INTRODUCTION

FOR Young Professionals (YPs) leadership development is perceived as crucial, and hence several programs have been proposed to address the need for learning and advancement of these skills [1], [2]. For the future and sustainability of IEEE, it is rather appropriate to question and wonder on the benefits, duties and drawbacks related to the status of YPs. There are several advantages of being a YP, such as working with a multidisciplinary team, collaborating with people from different backgrounds and being involved in high-responsibility tasks. However, despite these gains, the involvement of YPs does not lead to a long and durable

participation in the IEEE community. Indeed, recently the worrying issue of why a significant number of young members do not remain associated with the IEEE has been discussed [3]. Reasons behind the interruption are most likely due to membership fees, loss of commitment as a volunteer, insufficient engagement in IEEE activities and lack of support to attend conferences, to name a few [3]. Furthermore, in 2021, IEEE experienced the transition into the second year of the global COVID-19 pandemic [4]. In this context, the issue of IEEE evolving has been faced by strengthening the opportunities for young members and by developing new operational strategies [5]. Although in 2020 and 2021 the number of student members increased by 17% from 107,618 to 125,989, some concerning points related to engagement and membership have been observed. For example, only 2562 courses related to soft skills development have been taken on the IEEE Learning Network online portal [6]. Furthermore, for activities such as the IEEE Xtreme programming competition, 12,496 participants in 630 student branches and 62 countries worldwide have been registered. Moreover, the IEEE Annual Report 2021 [5] revealed that the revenues declined by 2% (\$1.2 million). The decrease in the income is in part due to student discounts, but also due to a decline in higher grade member dues revenue. Therefore, despite the number of young members increased (considered a low participation with respect to the great offer), the result is that only a part of these new members remain in IEEE and participate actively in it.

In this framework of relatively low participation of the YPs, the level of recognition for YPs engagement may not be sufficient or appropriate to the efforts that they spent in conducting IEEE activities. This aspect can be observed at many levels. Even though almost all IEEE societies have a YP group and dedicated committee, not all of them offer specific activities and engagement programs in technical and management tasks, *i.e.*, the IEEE societies' magazines. Approximately 80% of the magazines do not have a column or a space dedicated to YPs achievements and activities. Through

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editorial initiatives such as “YPs column”, “Membership column”, “Community Engagement,” “Education Corner” or “Meet our Volunteers”, the YPs can recognize themselves in what friends, colleagues and people with similar interests do and in the problems that they face. Furthermore, during IEEE conferences the organization of specific technical, award-related, or social events dedicated to YPs is not continuous. Some societies, such as the Microwave Theory and Technology (MTT), are currently investing in YPs to start initiatives, namely the MTT-S Affiliate Initiative, Student Ambassador, and the Distinguished YPs in Microwaves programs, aiming at giving YPs access to TC at the start of their academic, industry or government career [7]. The Antennas and Propagation society (AP-S) supported twelve YPs to continue the AP-S YP Ambassador Program for its second year [8]. Therefore, this situation demands a critical thinking and the development of suitable countermeasures. Thus dealing with the education, mentoring and development of a new generation of IEEE leadership, specific and effective initiatives must be established to address the engagement problem.

In this framework, the Nanotechnology Council (NTC) started a widespread and extensive set of actions for recruiting, educating and empowering YPs. For instance, recently, the cooperative interaction between all committees of NTC YPs led to the first world nanotechnology marathon [9]. This online event, held on the 24th of November 2021 and running for 24 hours, streamed the talks of 24 nanotechnology experts to a wide audience, inspired the new generation of nanotechnologists and YPs, and paved the route to a sustainable and active network of nanotechnology YPs worldwide.

The NTC strategy did not end with this successful experience. Hence, to further advance the level of engagement of YPs, the “NTC Mentoring program: from Effectiveness to Durability” has been proposed. The main MENED objectives are:

- To reach a high level of success in NTC activities, since the transfer of knowledge and experience represents a key factor in many NTC activities,
- To maximize the chance of new volunteers to reach their goals. This objective is oriented to the NTC volunteers, helping them to rapidly develop skills and bring solutions when charged with different tasks,
- To establish a mentoring culture. It concerns the durability of the NTC MENED program. Our understanding is that encouraging someone to improve skills reaps further rewards when mentoring someone else. The final goal here is to connect people and to create teams in which everyone brings ideas, trust and rapport.

The objectives of MENED program are defined with a lot of care about YPs and are intended to entail the following:

- involvement of more YPs in the NTC activities,
- training and mentoring young professionals of how to contribute to the NTC through the NTC Technical Committees (TCs),
- achievement of high satisfaction of TC chairs (usually

serving as TC mentors), as well as of YPs,

- establishment of guidelines and best practices of how to continue and operationalize this new initiative,
- education of ultimately better qualified and experienced YPs,
- increase of the number of trained NTC volunteers and help in the development of future generations of NTC leaders.

Thus, the MENED program encompasses these needs and draws the future. Its implementation would allow reaching a high level of success in the NTC activities, while maximizing the chance of new volunteers to reach their personal and career goals and establishing a mentoring culture in the council. Within the MENED program, YPs would have several tasks and duties. Mainly, YPs would participate in the TC meetings or help to organize technical webinars. The YPs and early career researchers will also support the review process of conference papers. Also, the social aspects and personal interactions will be an aspect covered by MENED. In fact, it focuses and enhances the interaction between YPs, as well as their ability to meet the NTC leadership and the NTC Publication Editors. By understanding and learning how the TC work, keeping a working diary, they will be able to participate and propose new TC initiatives. Both the YPs and TC mentors will evaluate the MENED program. In addition, TC mentors will be surveyed for evaluating the YPs, leading to a data-driven program adjustment and expansion.

The expected results were assessed and quantified with suitable metrics. In particular, from a quantitative point of view, the analysis was based on the number of interested YPs trainees and the YPs’ performance in terms of activities and engagement in the TCs. On the other hand, from a qualitative perspective, the quality of the YPs applications, the TC mentor’s satisfaction with the project and the YPs satisfaction with the project has been assessed.

This work presents the concept, the methodology and the first steps of the MENED program, and it is articulated as follows. In Sect. II we describe the methods employed for candidate selections, those used to run the first training session and the analysis of the results. In Sect. III the results of the initial assessment of the YPs’ perception of this IEEE experience are given, together with the quantitative analysis of TC mentor evaluations. Finally, in Sect. IV, conclusions are provided.

II. METHODS

A. CANDIDATE SELECTION

During the recruitment of the YPs for the NTC MENED program, several evaluation criteria have been used, namely:

- i) expertise level in the field of a selected TC,
- ii) experience in IEEE,
- iii) motives to volunteer for the TC.

These criteria reflect the technical and personal qualifications, and the attitudes of the applicants.

A dedicated evaluation committee analyzed the applications.

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Fig. 1. Pictures taken during the first training session of the MENED program.

The committee involved the NTC Vice President (VP) for Technical Activities (TA), acting as chair, the NTC VP TA Elect, the NTC VP for Educational Activities, the respective TC mentor and the NTC YP Representative.

B. MENED - FIRST TRAINING SESSION

Under the umbrella of the MENED project, after selecting the applicants, a first training session was planned. This session was held in conjunction with the 22nd IEEE International Conference on Nanotechnology (IEEE-NANO 2022), the 8th of July 2022, at the Campus of Balearic Islands University (UIB) in Palma, Spain (Fig. 1).

The first training session had multiple goals, such as deepen the YPs knowledge about the NTC and IEEE and their existence, objectives, and organization, and to provide details about the NTC Educational activities. Additionally, the creation of a network has been started by allowing the YPs to introduce themselves, describing their research activities and discussing their motivations for participating in MENED. In this way, the interaction between mentees has begun, searching for the best involvement strategy. In addition, the participants have been informed about the nature and activities of chapters, while presenting the best practices for their sustainability. The YPs have been told about the required capacities to apply for conference organization. In other words, during the training session both soft skills and professional development aspects have been covered [6]. Finally, the best practices of scientific papers review have been discussed.

After these points have been raised and faced, the in person and remotely connected YPs of the MENED project took part in a journey mapping experience. The gamification through the journey mapping is a typical educational and pedagogy method [10]. Journey mapping (JM), or experience maps, makes use of personas to help the member of a given community, or a design team, to better communicate with one another the impacts that a given state of things or design decisions will have on some users with given demographics. With this interactive approach, it is possible to humanize problems or potential opportunities by collecting, rationalizing, and analyzing demographic, ethnographic data. JM makes it easy to explain to project managers and stakeholders the needs of a community and enlighten the new paths to develop. In fact, in the user's experience science, it is well known that personas are a static representation of values and defects of a community [8]. Therefore, JM animates and graphically visualizes the changes in the user's needs, dynamically tracking the satisfaction with a

product, while providing feedback to marketing and management for improving service organization.

Typically, JM displays the major phases of a user's experience on a time axis to show its progression. On a second axis, the YPs were asked to add categories and metrics of particular interest to the IEEE NTC. The power of JM is strictly related to the creativity put into the metrics that the team can imagine [11]. Among the soft skills required for a YP there are communication, teamwork, flexibility and leadership, but, surely, creativity. As a matter of fact, creativity leads innovation and can drive an organization's performance [6]. If IEEE, in general, and NTC, in particular, could rely on YPs who can think differently, reversing the laymen's belief that a "creative engineer is an oxymoron" [6], then the development of innovative products and services could be sought, with tremendous benefits to our community.

During the first training session, the JM process consisted of the following six steps:

1. Set the targets,
2. Create YPs personas,
3. Identify motivations and pain points,
4. Maximize the touchpoints,
5. Describe the YPs journey,
6. Revise and validate.

Following the training session (~ 3 months later), a survey has been carried out in order to collect the feedback from the YPs and TCs participants.

C. TECHNICAL COMMITTEES PARTICIPANTS SURVEY ANALYSIS

As crucial part of the MENED program, a survey for TC chairs to evaluate YPs and the program has been performed. This survey aimed to:

- monitor the integration and participation level of the YPs in the TCs, and
- evaluate the satisfaction of the TCs chairs about the YPs.

The following questions have been asked of TCs members:

- QT1: What is your NTC Technical Committee?
- QT2: How satisfied are you with the concept of the MENED Program?
- QT3: Has the MENED Team offered you sufficient support? The possible answers were "Always", "Sometimes", "Never".
- QT4: Do you have all the necessary resources to accommodate the MENED YP participant? The possible answers were "Yes, I do", "No, I don't", "Can be improved".
- QT5: How easy was it to onboard the MENED YP participant? The possible answers were "Difficult", "Normal", "Easy".
- QT6: In what kind of activities did you involve the MENED YP participant? The possible replies were "Conference Organizing", "Paper Review", "Webinars", "So far learning about the TC operation", "TC Meetings and planning", "Other".
- QT7: How do you evaluate the involvement of the

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MENED YP participant in your Technical Committee? The possible replies were “Disappointing”, “Below expectations”, “Neutral”, “Satisfactory”, “Good”, “Very good”, “Above expectations”.

- QT8: Do you think that the MENED YP participant should be recognized for his/her activities?
- QT9: How can we improve the implementation of the MENED program?
- QT10: Do you have any comments, suggestions, or recommendations?

D. Participants Survey Analysis

In order to qualitatively and quantitatively assess the progression of the MENED program, and to verify if its objectives have been reached, the YPs participants have been surveyed. The following questions have been asked of YPs:

- QY1: What is your NTC Technical Committee?
- QY2: How satisfied are you with the concept of the MENED Program?
- QY3: How do you evaluate the application process?
- QY4: Has the MENED Team offered you sufficient support? The possible answers were “Always”, “Sometimes”, “Rarely”, “Never”.
- QY5: How easy was the onboarding in the Technical Committee? The possible answers were “Very difficult”, “Difficult”, “As expected”, “Easy”, “Very Easy” and “Effortless”.
- QY6: In what kind of activities have you been involved? The possible replies were “Conference Organizing”, “Paper Review”, “Webinars”, “So far learning about the TC operation”, “TC Meetings and planning”, “Other”.

- QY7: How do you evaluate the support from your TC Chair? The possible replies were “Below expectations”, “Negative”, “Need improvements”, “As expected”, “Good”, “Fantastic”.
- QY8: Would you like to share any comments/impressions regarding your cooperation with the TC Chair?
- QY9: How do you evaluate the training session in Palma? The possible answers were “Not valuable”, “Somehow valuable”, “As expected”, “Valuable”, “Very Valuable”, “Best one ever”.
- QY10: Do you have any comments regarding the training session in Palma?
- QY11: How can we improve the implementation of the MENED program?
- QY12: Do you have any comments, suggestions, or recommendations?

It can be noticed that, with respect to the set of questions asked to the TCs chairs, there are some slight differences aimed at evaluating the different point of view of the involved parties. For YPs two more questions have been included.

III. RESULTS

For a total of 75 Applications (Fig. 2a), only 17 applicants, *i.e.*, one per NTC TC, have been selected (~ 3.6%). The geographical distribution of the selected YPs is relatively balanced. Five participants from IEEE Regions 1-7, and Region 9, while six are from Region 8, and, finally, six belongs to Region 10 (Fig. 2b). A stimulating for the MENED program point was that all NTC TCs were selected by the applicants (Fig. 2c), revealing the fact that the TC technical areas are popular among the YPs and attract their interest. As regards the specific TCs, as can be observed from Fig. 2c, the technical and

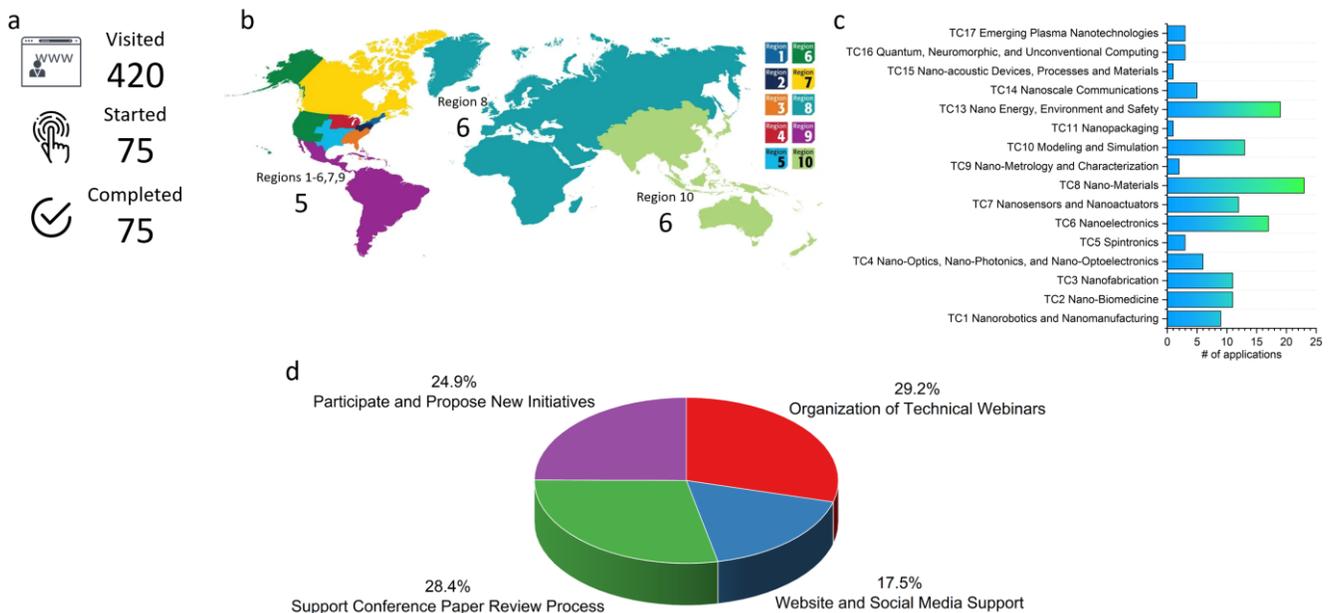


Fig. 2. a) Statistics of the applications, b) Geographical distribution of the participants, c) Interest in the different NTC TCs, and d) Interest in the different activities of the young professional (YPs).

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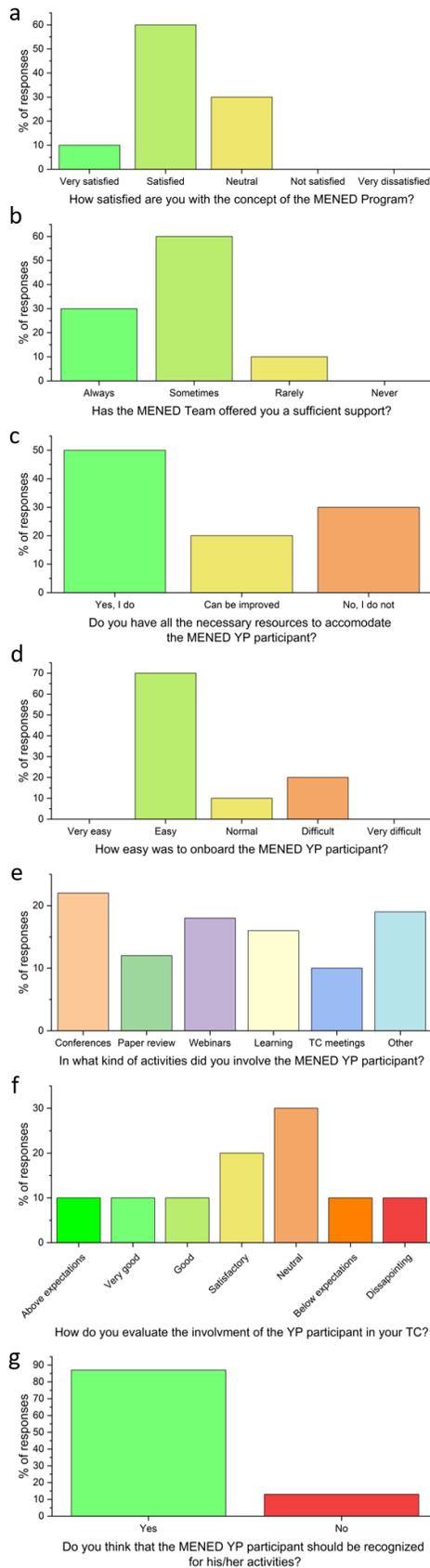


Fig. 3. Technical Committees survey results. Each sub-figure represents the response to a consecutive question, as given in Sec. II.C.

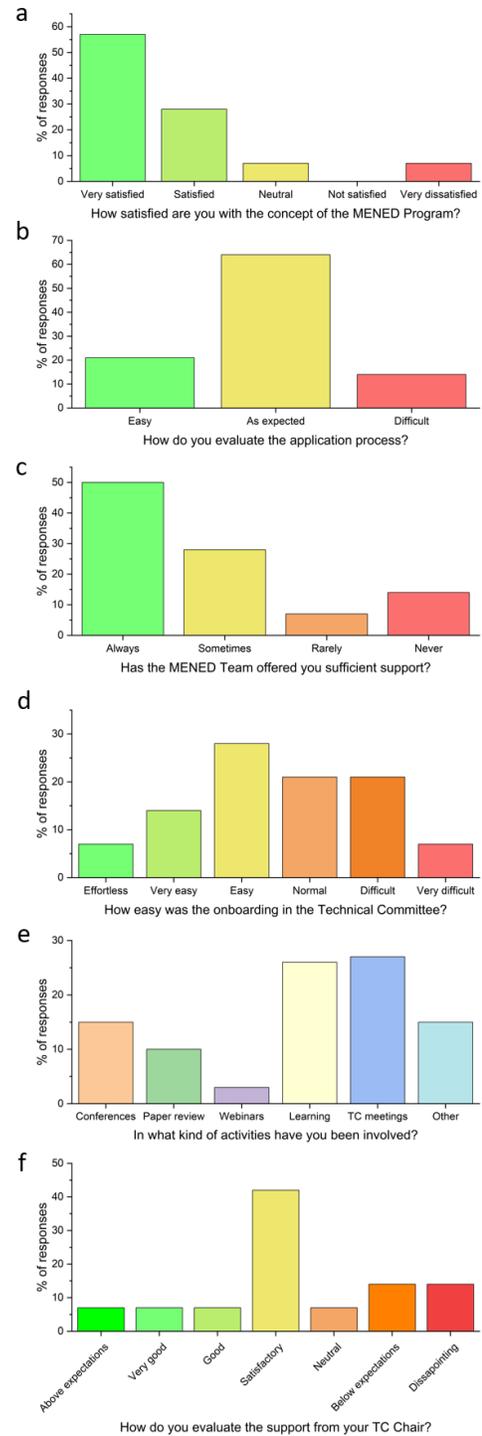


Fig. 4. Young Professionals survey results. Each sub-figure represents the response to the consecutive questions, as given in Sec. II.D.

scientific interests of the candidates are quite spread. The most preferred topics were nano-electronics, nanomaterials and nano-energy, environment, and safety (Fig. 2c). This is the spread but promising context of the YPs that took part in the MENED program.

Among the applicants, 17.5% declared to have interest in the management of the website and social media, while 29.2% of the YPs are oriented to technology organization, as shown in

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Fig. 2. 24.9% of the applicants are interested in participating and proposing new initiatives in the NTC TCs. The remaining 28.4% of the YPs would like to provide support to the conference paper review process (Fig. 2d).

About three months after the beginning of the MENED program, it was mandatory to assess the experiences of both the YPs and the TC mentors. The results from the survey of the TC mentors are provided in Fig. 3. Each sub-figure represents the response to a consecutive question, as given in Sec. II.C. The replies from the YPs are given in Fig. 4 with the same logic applied. From the TC mentors the response rate was 58.8%, while the YP response rate achieved 70.5%. Therefore, it should be noticed that the level of satisfaction and engagement cannot be analyzed completely. This aspect may appear as a shortcoming, but the results from the survey must be considered as a valuable capture of the current state of the NTC community. It can be noticed that for ~35% of the replies we have the opinions of both TCs and YPs. For the other cases, we have a partial, unbalanced situation, that still deserves to be analyzed.

As regards the level of satisfaction with the concept of the MENED program (*i.e.*, QT2, QY2), 60% of TC mentors were satisfied (Fig. 3a), whilst 50% of YPs were very satisfied (Fig. 4a). Surprisingly, one can notice that 8.3% of YPs were not satisfied by the MENED concepts. For question QY3, more than half of the YPs (58.3%, Fig. 4b) evaluated the application process to be adequate.

By comparing Fig. 3b and Fig. 4c, it is possible to notice that the number of YPs that benefit from the support of the MENED teams is higher than the TC mentors (41.7% vs. 30%, respectively). There is a concerning quote of YPs (16.6%, Fig. 4d) that experienced difficulties in receiving help. From Fig. 3c, it can be noticed that half of the TCs Chairs considered they have all the necessary resources to accommodate the MENED YPs participants. On the other hand, 30% of the TC mentors expressed the opinion that their resources for the accommodation were not adequate. Only 20% of the TC mentors report that the accommodation resources could be improved. For the onboarding in the TC, by comparing Fig. 3d and Fig. 4d, it can be observed that TC mentors perceived less difficulties (*i.e.*, 70% “Easy”), but most of the YPs considered the beginning to be a more complex experience. After the onboarding phase, the YPs have been involved in different activities. At the beginning of MENED program, both TC mentors and YPs expressed the impression that it was not clear enough what YPs can actually and practically do for TCs. However, in this work this point has been clarified. From the merging and averaging of the replies from TC chairs and YPs (Fig. 3e and Fig. 4e), it can be seen that 20% of participants have been involved in conference organization. Around 10% (12.8% vs. 7.6%) of the YPs took part in paper reviews. A satisfactory number of participants coped with the learning about TC operations, as well as with TC meeting and planning.

When comparing the level of involvement of YP participants from the TCs (Fig. 3f, QT7) with the support from their TC mentors (Fig. 4f, QY7), interesting perspectives can be found. TC mentors are generally neutral (30%) or express more satisfied opinions (20%) of the YP involvement (Fig. 3f, QT7).

Given the opinion of the TC mentors about the YPs’ involvement and work, and considering that two answers have not been submitted, 87.5% of them positively answered to the question about the recognition of the YPs efforts (Fig. 3g). This is a great point, considered that the recognition has been highlighted to be a key aspect for empowering enthusiastic volunteers.

On the other hand, ~40% of the YPs experienced the expected level of support during the MENED program. The other ~40% of the YPs considered the support to be below expectations or that it needs improvement. Finally, the 17% perceived positive support from the TC mentors. To deepen this aspect, question QY8 has been asked of the YPs. Half of the responding YPs provided interesting comments and impressions regarding their cooperation with the TC mentors (Fig. 4g). They consider that the level of involvement should be improved, and that the tasks and duties require clarification when presented and discussed. The same transpires from the replies to QT9 asked of the TC mentors. Even though some TC mentors skipped the question about how to improve the implementation of the MENED program (QT9), it has been suggested that a training session and guidelines for mentors could be provided.

Then, YPs were asked about their impressions on the first training session. In particular, by answering to QY9, more than 40% judge it to be very valuable, whilst ~32% considered it to be valuable and the best one ever. The remaining 25% of the answers were more conservative or containing some critical but positively charged elements. However, these are valuable feedback for the next training session and for future editions of the MENED program. Question QY10 intended to gather general comments about the first training session. All the surveyed YPs replied, and it must be reported that the way the training session has been organized offered the opportunity to gain and learn some insight in the organizational and the structural aspects of IEEE and of the NTC. Also, the JM experience gave the YPs the opportunity to reason and think about the interactions of potential members, early career researchers and YPs with IEEE.

The YPs offered a broad and appealing set of answers to QY11. In particular, YPs suggested enlarged global participation, through the collaboration with industries and academicians, social media advertising and more interactions, such as the sharing between the participants by chat, community, web meetings, *etc.* Furthermore, it has been suggested to establish routine TC meetings, and to set achievable targets for each member, through a series of tasks that could be assigned via an online portal.

IV. CONCLUSIONS

The problem of engaging, educating, mentoring, and creating a new IEEE leadership is an urgent concerning issue for our community. Within the IEEE NTC, immediate countermeasures have been considered. This work dealt with the experience, methodology and the results of the NTC Mentoring from Effectiveness to Durability” (MENED) program. Details related to the candidate selection, the first training session, the journey mapping experiment, and the

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survey methodology have been provided. The qualitative and quantitative analysis of the results lead to the conclusion that the MENED program has positively impacted on YPs, but also on the TC mentors, thus creating a pool of empowered volunteers for the next generation IEEE community.

The MENED program is entering its second year. It is now well recognized and targets also common actions with other NTC activities, like shared sessions between NTC MENED and NTC Technical Activity Workshop (TAW), with the latter gathering the NTC TC Chairs and Representatives of the NTC Member Societies. The idea, methodologies and results of the MENED experience are of interest to the NTC community but can be also beneficial to the whole IEEE community, inspiring and fostering the YP involvements.

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