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Science communication on TikTok: toward transformative and post-normal science

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Science communication on social media is becoming increasingly important in order to promote an open dialog between science and the public. This raises the question of how to present topics related to climate change in a way that is both scientific and tailored to a non-specialist audience. The article takes up this question through the lenses of transformative and post-normal science using the TikTok channel @energiewende.erklaert run by Dr. Eva-Maria Grommes as an example. The case study illustrates how an individual researcher approaches science communication in an interactive way and demonstrates how scientific findings on the energy transition are communicated based on the needs expressed by those interacting with the researcher's content. @energiewende.erklaert effectively introduces scientific results into public discourse while maintaining scientific integrity and promoting inclusivity. Therefore, @energiewende.erklaert and TikTok act as a platform for scientists to experiment with interactive science communication. Dr. Eva-Maria Grommes acts as a representative of transformative science by stimulating debates outside the scientific system. At the same time, the content of @energiewende.erklaert is subject to post-normal conditions and thus allows conclusions to be drawn about lived practices, norms and roles. Ultimately, this highlights competences that researchers need beyond tailoring scientific findings to a non-specialist audience.

KEYWORDS

transformative science, post-normal science, TikTok, energy transition, science communication

1 Introduction

The energy transition is a key issue in mitigating the climate crisis and plays a central role both in research and in the public debate (IPCC, 2023; Yu et al., 2024). Scientific disciplines as well as public actors view the energy transition from different perspectives, which illustrates the complexity of the discourse and the difficulties arising while implementing the energy transition globally and locally. The expansion of wind power plants and the decommissioning of coal-fired power plants require more than just scientific considerations in order to shape and foster the needed changes (Radtke and Kersting, 2018).

For science communication, the energy transition is an important and interesting topic. The debate is often dominated by people and groups with specific interests who deliberately spread disinformation, unconsciously spread misinformation (Turăcilo and Obrenović, 2020) or use politically motivated arguments to back-up their views (Brettschneider, 2019).

On the one hand, science communication can help to initiate and maintain a discourse between different stakeholders. On the other hand, the energy transition illustrates how students, lecturers and researchers from all disciplines involved can share their study and research findings or those of others with the public and enter into a social discourse on an equal footing. With @energiewende.erklaert, we present an example for both perspectives.

@energiewende.erklaert is a TikTok channel that has been dedicated to communicating complex energy transition topics to a broad target group since June 2022. Dr. Eva-Maria Grommes (EMG) is the owner of the channel and produces content based on scientific sources answering questions regarding the energy transition and climate crisis from interested people in the comments section of the channel. The aim of @energiewende.erklaert is to highlight the significance and the challenges of the energy transition in a simple and understandable way, without imposing these challenges themselves, and thus to enter into a dialogue with the general public and especially people who criticize or outright reject the energy transition.

Drawing on the perspectives of transformative and post-normal science, this paper analyzes @energiewende.erklaert to examine the extent to which this format is suitable for bringing scientific knowledge into the societal sphere, for fostering exchange rather than simply relying on the deficit model (Trench, 2008), and for discussing complex issues across the scientific and societal spheres alike. The aim is to use communication science approaches to examine the scientific added value and framework of @energiewende.erklaert and to demonstrate, by example, what transformative and post-normal science can look like. Building on this study, examples are shown of how transformative science and post-normal science can be exemplified, and thus show specific ways to engage in science communication as a researcher with the help of social media. In addition, the reflections on @energiewende.erklaert presented here can be relevant and thought-provoking for teaching-learning contexts and thus promote transformative teaching or post-normal science in curricula.

The article is divided into six sections. While the theoretical foundations of transformative and post-normal science are presented in the second section alongside an overview of science communication on TikTok, @energiewende.erklaert is further introduced in the third section. The fourth section uses the two modes of science and science communication to analyze the extent to which @energiewende.erklaert can be an example of transformative and post-normal science. The fifth section provides a discussion and the sixth section summarizes considerations, draws conclusions, and identifies possible new approaches for science communication and its integration into future curricula.

2 Settings of science communication

Discussions on redefining the role of science in society have a long history. These debates encompass various concepts such as action research, technology assessment, post-normal science and knowledge production mode 2, which emphasize transdisciplinarity as a key research principle, and transformative science. While transformative research stresses the need for science to take responsibility for actively participating as a social actor in societal change, post-normal science focuses on the social and scientific settings and the roles and practices of researchers within these settings (Heuchemer and Meinhardt, 2024). Transdisciplinarity as a practice centers the research process in between social and scientific practice and is understood in this paper to practice co-creation to generate knowledge and find solutions for real-world problems together with societal actors (Lawrence et al., 2022). To discuss the setting of science communication on TikTok, a more detailed description on the concepts of transformative science and post-normal science will be given in the following.

2.1 Transformative science

> "'Transformative science' is a concept that delineates the new role of science for knowledge societies in the age of reflexive modernity. [...] The aim of transformative science is to achieve a deeper understanding of ongoing transformations and increased societal capacity for reflexivity with regard to these fundamental change processes" (Schneidewind et al., 2016, p. 2).

Transformative science attempts to initiate social change processes and act as a catalyst through a combination of transformative teaching and research as well as institutional change in the science system. Closely linked to the theme of transformative science is the desire to find new ways of democratizing the science system, through which science takes responsibility for current societal challenges (Schneidewind and Wissel, 2015; Schneidewind et al., 2016; Singer-Brodowski et al., 2021). While transformative teaching and learning (Singer-Brodowski et al., 2021; Taimur and Ross, 2023) aims to motivate students to engage with socially relevant topics and reflect on the significance of scientific activity, transformative research focuses on the social impact of research and identifies solutions to technical and social problems. For example, the German Advisory Council on Global Change defines transformative science as follows:

> "Transformative research supports transformation processes in practical terms through the development of solutions and technical and social innovations, including diffusion processes in economy and society, and opportunities for their acceleration, and demands, at least in part, systemic perspectives and inter as well as transdisciplinary procedure methods, including stakeholder participation" (German Advisory Councilon Global Change, 2011, p. 322).

The establishment of scientific change can take place at various levels. On the one hand, scientific institutions, universities or individual departments establish transformative science as a focal point. On the other hand, all researchers are also called upon individually to promote transformative processes at an individual level and to assume responsibility for society on the basis of scientific standards (Schneidewind et al., 2016; Singer-Brodowski et al., 2021).

Criticism of transformative science is voiced by sustainability researchers and has, for example, led to a major debate in Germany (Schneidewind et al., 2016). In this debate, Strohschneider (2014) lists four central points of criticism of transformative science: Firstly, Strohschneider criticizes the fact that transformative science leads to research being reduced to a problem and solution scheme, thereby curtailing interest-driven and self-serving research. Secondly, he points out that through transformative science, an extra-scientific frame of reference determines scientific questions and thus devalues the internal scientific criteria of the individual disciplines. Closely linked to these considerations is his third point of criticism, in which he accuses transformative science of restricting the diversity and plurality within scientific discourses of truth by asking questions about utility and increasingly forcing researchers into an expertise-centered role for social problem areas. Fourthly, this would result in political decisions and debates being determined by researchers who have no democratic legitimacy.

This brief introduction already shows that the concept of transformative science encompasses very different processes and actors, has various areas of tension and affects the different university levels, i.e., the marko, meso and micro levels (Ulrich and Heckmann, 2017). This article focuses on the question of how individual researchers contribute to the social discourse and react to social challenges in the sense of transformative science. The other aspects of transformative science are not considered.

As there is currently a lack of precise criteria to identify researchers conducting transformative research, this article derives possible indicators from the definition presented here and the points of criticism. According to this definition, individual researchers conduct transformative research when they address social and/or political issues, take a stand in public discourse and initiate change processes that lie outside the academic system. As the points of criticism outlined above make clear, it is important on the one hand that researchers do not restrict their research and subject it to an ends-means relationship or disregard internal scientific criteria when entering into a social discourse. On the other hand, they should also observe the framework structures of a public discourse and understand that their scientific findings have no democratic legitimation. In transformative research, researchers enter the political space in which their scientific findings become one aspect of many that must be discussed and may encounter resistance that is not necessarily based on scientific criteria. Transformative researchers therefore operate in a field of tension and must fulfill both the demands of their scientific discipline and the requirements of public discourse. From these considerations, initial indications for transformative research can be derived. However, these assumptions are general, for which reason, in addition to transformative science, the approach of post-normal science will be presented in the following section.

2.2 Post-normal science

Science in the ideal-typical normal mode can be illustrated by both the metaphor of unriddling and that of discovery (Brüggemann et al., 2020; Kuhn, 1970). It expands existing knowledge, discovers neighboring knowledge and puts together pieces of a puzzle that has not yet been fully unraveled. Science in the ideal-typical post-normal mode, which is not to be understood as a transformed normal mode, but as an additional complement to the normal mode under post-normal conditions (Brüggemann et al., 2020), clearly detaches itself from these metaphors (Funtowicz and Ravetz, 1990).

Post-normal conditions and issues are characterized by the overlap of four features: "facts are uncertain, values in dispute, stakes high and decisions urgent" (Funtowicz and Ravetz, 1990, p. 20). A high degree of scientific uncertainty meets science policy considerations that include societal values and not just scientific knowledge, as well as high societal relevance and an urgent need for political decisions (Fleerackers et al., 2022). Frequently cited examples are the COVID-19 pandemic in the 2020s and the climate crisis (Fleerackers et al., 2022; Krauss et al., 2012). In both cases, science and researchers find themselves in post-normal conditions (Nogueira et al., 2021). It should be noted that each of the four dimensions is a spectrum, and it has not yet been discussed at what thresholds—individually or in combination—conditions can be categorized as post-normal.

Communication about science from within science has traditionally been directed at two different publics, the scientific (scholarly communication) and the societal (science communication). While scholarly communication (internal) has always been considered an integral part of science and is a contribution to a researcher's reputation, science communication (external) has not been traditionally (Liang et al., 2014). Over the last few decades, however, conditions and challenges have changed and the boundary between scholarly and science communication has become increasingly blurred due to digitalisation, social media and open science (Bonfadelli et al., 2017) as well as due to transdisciplinary, transformative and citizen science. Citizen science in its broadest meaning describes the active participation of people in scientific processes not institutionally linked to that scientific field (Haklay et al., 2021; Bonn et al., 2021). In the ideal-typical normal mode, researchers do not take a proactive role in communicating with the public (Brüggemann et al., 2020). Journalistic media, political decision-makers and citizens themselves turn to researchers, not the other way round. Thus, science communication is not an integral part of normal science, as it is not essential for the persistence and the progress of science. In the post-normal mode, the roles and behavior of researchers shift. Table 1 provides an overview of the practices, roles and norms found in the literature under post-normal conditions, with minor restructuring and interpretation. They take up proactive communication with the public in being public communicators for not only scientific results but also processes. The norms even go so far as to include researchers showing their own emotions and incorporating the interests of the public into their own research.

The analytical framework provided by Brüggemann et al. (2020) for the exploration of post-normal science communication encompasses not only the intensified media discourse but also the changing norms, roles and practices, which in turn have an impact on communicators and society, further contributing to the post-normal conditions. This emphasizes the embedding nature of post-normal conditions, which leads to science communication being an integral part of post-normal science.

TABLE 1 The roles of scientists, as well as the norms and practices of science and science communication, under post-normal conditions.

Category	Comment
Roles	
Brokers	of consensus, dialogue, ideas, knowledge
Advocates/defenders	for/of common goods such as democracy, academic freedom, freedom of the press
Public communicators	of scientific results and processes
Practices	
Proactive communication with the public	Intensive interaction with journalists, politicians, and the general public (before peer review, e.g., using blogs or social media), provision of context and interpretation, statement of own values and emotions
Norms	
Advocacy/defense	for common goods beyond research expertise
Interpretation	of scientific facts and beyond research results, e.g., implications, weighting of evidence
Transparency	methods and processes, own values, uncertainties
Emotionality	display own emotions
Participation	extended peer community beyond the boundaries of the academic community
Public service	addressing the public, adaption of public interests
Immediacy	contributing knowledge to public discussions and political decision-making

This is based on Brüggemann et al. (2020), and has been modified based on the findings of Nicolaisen (2022), with minor restructuring and further explanations.

Based on Brüggemann et al. (2020) and Nicolaisen (2022), we conclude that when analyzing specific formats of science communication and exploring their post-normal characteristics, the aim is not to check whether the science communication in question fulfills the listed roles, norms and practices in order to prove its post-normal character. Rather, the aim is to classify the science communication according to the four characteristics of post-normal science introduced by Funtowicz and Ravetz (1990) and to examine which roles, norms and practices are actually practiced.

2.3 Science communication on TikTok

TikTok is a platform for creating and sharing short video content, first released in 2017, which has gained immense global popularity. Despite its success, the platform faces criticism due to its Chinese ownership and its popularity with younger, often underage, users. However, TikTok has become a hub for creativity and is increasingly used by educators and governments to engage younger demographics (Zeng et al., 2021).

A cross-cultural study conducted in early 2024 revealed insights into user behavior and motivations on TikTok, emphasizing its role in information exchange and community building (Bestvater, 2024). This study highlighted that TikTok users, particularly younger adults, find the algorithmically curated "For You" page interesting and engaging, with many users actively participating by posting videos. Kemp (2023) indicates that this is effective, with half of all internet users between the ages of 16 and 64 searching for video content to learn.

At the time of writing (May 2025), Facebook remains the most popular social media platform worldwide, followed by YouTube in second place (Dixon, 2025). Instagram ranks third, while TikTok is fifth with approximately 1.6 billion monthly active users. Both Instagram and YouTube compete with TikTok through their short-form video features, Reels and Shorts, respectively.

Social media platforms, such as TikTok, provide a medium for information exchange and facilitate the formation of communities, enabling the involvement of diverse groups of people. There is a wide range of science communication formats and also a wide range of people doing science communication on TikTok. Showing and explaining experiments (Zawacki et al., 2022) with voice overs takes place as well as lecture-style videos (Habibi and Salim, 2021) or people just talking to their followers directly and explaining something they personally and professionally are interested in. Professional and successful science communicators like Hank Green or astronauts as well as smaller science communicators and scientists are among those communicating science on TikTok. While English-speaking accounts address a global audience, German-speaking accounts target German-speakers and therefore a much smaller community. Their followings and views are therefore smaller.

3 @energiewende.erklaert

This paper involves EMG and her TikTok account @energiewende.erklaert as objects of research for the case study. This study was reviewed and approved by the Research Ethics Committee of the University of Applied Sciences Cologne. EMG is one of the co-authors of this paper and hereby provides informed consent.

3.1 Evolution

@energiewende.erklaert has been launched on the short video platform TikTok in June 2022. EMG answers questions from her commentators on the energy transition in video form and presents research projects on energy transition topics. As of May 19th 2025, 221 videos are available on the TikTok channel. An overview of the TikTok channels landing page is displayed in Figure 1. The aim of the TikTok channel is to focus on the importance and challenges of the energy transition and to raise awareness of the relevant issues such as climate change, electric mobility and future storage. @energiewende.erklaert deals with topics relating to the energy transition, such as the energy amortization time of photovoltaic systems, grid security through renewable energies and the integration of electromobility into the energy system.

The target group consists of generations Z and Y as well as people who reject or criticize the energy transition. The initial approach to the target group of opponents of the energy transition was not sufficiently proactive. Following the uploading of the first video to the channel, EMG became

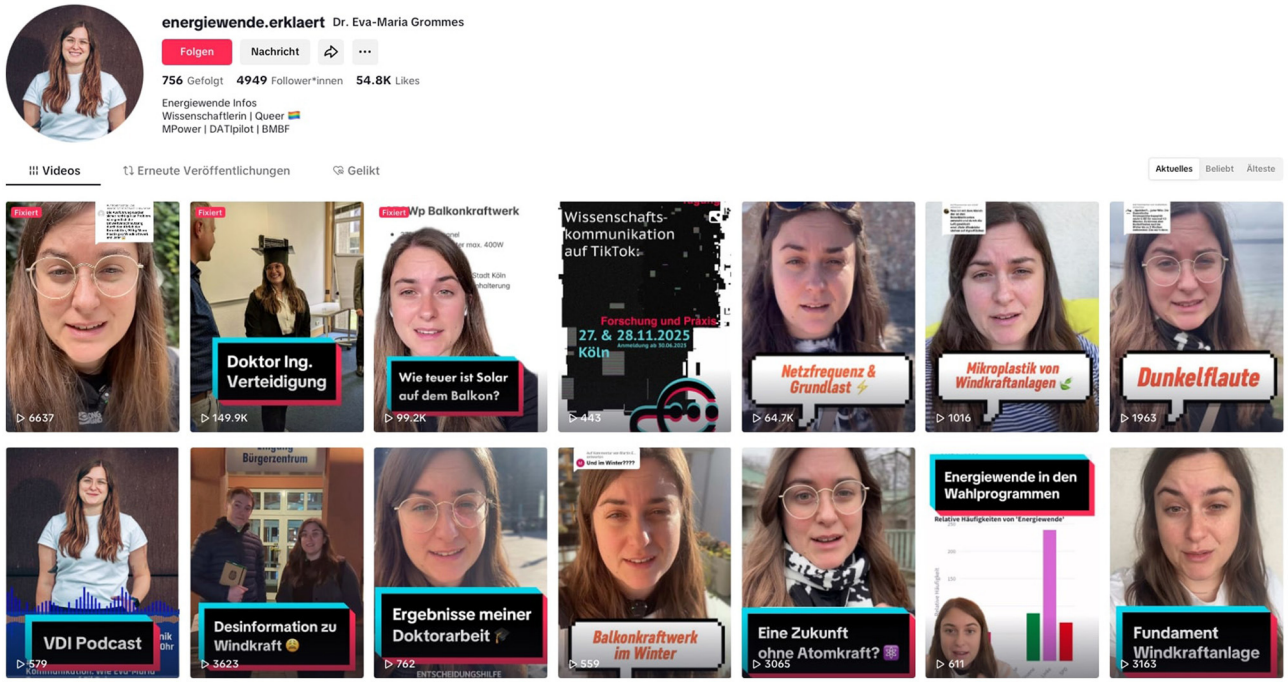

FIGURE 1
Landing Page of the TikTok channel @energiewende.erklaert (May 19, 2025).

aware that a significant proportion of the comments were from opponents. Consequently, they have since been engaged as a target group.

3.2 Content and formats

The channel endeavors to explain complex topics like base load or residual load as simply as possible and tries to imitate a direct conversation with the interaction group at eye level. The proximity between the scientist and the commentators is also created through the possibility of direct interaction in the comments. The content of the videos is based on academic publications, some of which are quoted in the video or supplemented in the comments. At the center of the channel is a format in which questions from the comments are answered by video. There are also formats in which research projects are presented and myths about the energy transition are clarified.

The channel mainly uses the interaction option of discussion in the comments. There are also occasional TikTok live streams, but so far no direct reaction to videos to or from other channels (stitches). EMG's interaction with comments can take place in video form or in text form. In the video form, there are two different formats: in the first, EMG asks viewers to ask her questions in the comments, which she then answers. In the second format, she responds to questions or statements in the comments, some of which are of a technical or scientific nature (e.g., "How do we solve the problem with the base load? [...]"), in some cases the commentators also question EMG's expertise or research integrity (e.g., "Another expert [...]").

3.3 Featured guests

In addition to EMG, other researchers appear on the channel and answer questions about their specialism or present their research on the energy transition. By selecting actors, EMG ensures that they possess the requisite professional qualifications and are amenable to active participation in video formats. Many actors are initially reluctant to engage in filmed interviews and to be featured on social media with an on-camera interview. These collaborations involve scientists and also stakeholders from the business community, with the objective of addressing topics related to the application of scientific knowledge. In both cases, there is a multiplier effect, as the actors are motivated to engage in science communication themselves in the future. EMG speaks on the channel as a private individual, but emphasizes her scientific work and approach to topics. This is also reflected in the description of the TikTok channel, in which the roles are mentioned. When the channel started, it stated doctoral student and engineer, but now it simply states researcher since EMBs has graduated. If there are personal assessments, they are labeled as such.

3.4 Outreach

There is no single metric that represents the reach of a TikTok channel, as it is influenced by several factors: number of followers of the channel, number of video views, number of comments and the interaction rate per video. An analysis in August 2024 showed that the channel had close to 4,500 followers on TikTok, the video with the most views had been viewed close to 150,000 times, the

most commented video had 716 comments with 21,000 views. The average interaction rate across 100 published videos was 7.3% with total views of around 590,000. The highest interaction rate of a single TikTok was 15.7%, which means that this proportion of the following had interacted with the video. In comparison, the average interaction rate of the same videos on the social media platform Instagram was 3.9% with total views of around 434,000. This leads to the assumption that the target groups on TikTok are more willing to comment on and interact with videos than on Instagram.

4 Positioning of @energiewende.erklaert

4.1 Is @energiewende.erklaert transformative science?

By presenting scientific research projects on the energy transition on TikTok and answering questions from viewers, scientist EMG addresses a highly relevant political and social issue and views it from a scientific perspective. According to the definition of Schneidewind (2015), she is therefore considered a representative of transformative science, as in her role as researcher in engineering, she initiates a social debate on the energy transition outside the university and science system and acts outside of it. In this context, she can be seen as a multiplier, bringing together both scientists and other members of society to initiate a transdisciplinary discourse on aspects of climate change. In particular, inviting other scientists seems to be a possible way to promote transformative science, which could encourage them to share their findings with a wider audience or adopt social media platforms such as TikTok for communication and/or teaching purposes.

However, this approach by EMG should only be understood as a stimulus that may have an effect on other scientists, but does not fundamentally create an interest in transformative science. Nevertheless, it is a way for other scientists to get to know new and more interactive formats of science communication at a low threshold and to get a first idea of transformative science without much prior knowledge or effort. In this case, the participant scientists would invest, for example, 30 min for the video shoot, with EMG investing an additional 120 min for preparation and editing, instead of having to do all this themselves. Furthermore, quotes such as the following comment on her TikTok channel show that EMG uses her channel to promote social exchange with people outside of science and emphasizes diversity within research: "Such a great channel! It deserves way more followers! I've been listening to scientists for a long time—but unfortunately they're all men otherwise and I think that's a shame. Because science is so mixed and diverse, that should be reflected. Regardless of that: top content!"

@energiewende.erklaert is also of particular interest with regard to the critical aspects described above. With its different formats—presentation of research projects, answering questions, entering the social discourse by referring to scientific references—it shows how researchers as communicators can take on a role in the public discourse on a specific topic without disregarding scientific criteria or placing themselves above the open, democratic discourse. "Getting direct comments and feedback from diverse people on social media reveals a very different information need than I expected. The questions are often much more practical or they deal with issues that we rarely deal with in research, such as small wind turbines" (EMG).

However, the problematic comments that @energiewende.erklaert receives from some viewers in response to videos show how challenging the realization of transformative science can sometimes be. In these, for example, EMG is denied her expertise or research integrity or reduced to her appearance (Grommes et al., 2025). In addition to the interest in enriching public discourse with a scientific perspective and discussing a range of topics with different social groups, transformative researchers therefore need a certain inner attitude and resilience. This enables them to react to inappropriate, presumptuous or insulting statements, both publicly and privately, which differ significantly from the scientific discourse practices.

4.2 How does post-normal science present itself in @energiewende.erklaert?

The energy transition is embedded in the issue of the climate crisis and therefore fulfills the four characteristics of post-normal conditions, i.e., "facts are uncertain, values in dispute, stakes high and decisions urgent" (Funtowicz and Ravetz, 1990, p. 20). The effectiveness, scalability and future development of the energy sector and individual technologies are associated with a high degree of scientific uncertainty. Science policy considerations on individual technologies involve societal values and not just evidence, for example when it comes to the construction of power lines. Societal relevance is very high, as meeting climate targets depends in part on the success of the energy transition. The need for political decisions in the energy sector in the near future is groundbreaking and crucial. It should also be emphasized that the current issues of the energy transition and the field of research itself have never existed under purely normal conditions, as they are—in the current form—a consequence of the climate crisis. With these premises in mind, we can now take a look at @energiewende.erklaert by refering to Table 1.

@energiewende.erklaert demonstrates the practice of proactive communication with the public by directly addressing the general public. EMG repeatedly sets out her and her content's scientific context as that of the energy transition. EMG only rarely takes on the role of broker, building a bridge between contradictory ideas and values at the interface between science and politics, for example when she talks about the bureaucratisation of the construction of photovoltaic systems or the special position of the combustion engine. The norm of advocacy and defense as well as the corresponding role are hardly recognizable in @energiewende.erklaert, but are certainly attributed externally, e.g., in the form of accusations of activism in the comments. This at least applies to the classic understanding of activism in the political sense. However, the fact that EMG acts as an advocate and defender of scientific findings and practices can be seen as a given and shows "that scientists [...] become advocates, but not necessarily in the conventional and narrow sense" (Brüggemann et al., 2020, p. 11).

The norm of interpretation, in which the context as well as the degree of evidence and the implications of the scientific findings are addressed and communicated in addition to pure facts, is given a lot of space in @energiewende.erklaert. Researchers "must [...] put these facts into context, if they do not want to leave this up to [...] readers in the comments section." (Brüggemann et al., 2020, p. 12). EMG thus anticipates what the comment sections would otherwise do. The norms of transparency and emotionality are mixed in @energiewende.erklaert. The statement that the "image of the pure scientist as a disinterested, value-free researcher [...] cannot be upheld" (Brüggemann et al., 2020, p. 10) applies to EMG and her content. She occasionally expresses her personal assessments, e.g., on hydrogen as a future technology, continuously conveys uncertainties or limitations of scientific results and addresses the fact that the amount of problematic comments does not pass her and her communication activity by without a trace.

The norm of participation is only practiced to a limited extent in @energiewende.erklaert. While not all perspectives on reality from the comments are presented and taken up as equally legitimate, EMG, on the other hand, invites other researchers or professional groups, such as a building technician, to her channel and cooperated with the World Wide Fund for Nature (WWF). In this way, she includes other voices in the extended peer community and presents selected "other (non-scientific) views as legitimate" (Brüggemann et al., 2020, p. 10).

@energiewende.erklaert gives space to critical questions and conflicting comments, since "[c]onstructive results depend on researchers addressing colliding worldviews, worries, vocabularies and interests" (Nogueira et al., 2021, p. 2), but does not allow them as legitimate. The format of answering questions opens up and perpetuates the dialogue and lives the idea that "everyone has something to learn from everyone else" (Funtowicz and Ravetz, 1990, p. 363). The mutual exchange of open questions is also part of learning from each other and drives the dialogue forward. However, this is where participation in @energiewende.erklaert ends. Co-production of research or higher levels of participation are not sought or achieved.

The norm of service for the public is the basic building block and motivation of @energiewende.erklaert. It was conceived with an explicit focus on orientation toward the public and, as the present work shows, influences her scientific questions and publications. The norm of immediacy, on the other hand, plays no role in the project. Only the aspect of addressing current topics, e.g., hydrogen or blackout, reflects the fact that "scientists might more frequently orient their science communication toward the norm of immediacy" (Brüggemann et al., 2020, p. 14). There is no continuous exchange during an entire research process but only when EMG initiates it.

5 Discussion

In this article, @energiewende.erklaert was contextualized and it was shown that characteristics of transformative science and post-normal science can be found or are evident in @energiewende.erklaert. From the perspective of transformative science, it is particularly noteworthy how EMG succeeds in introducing scientific findings into a public discourse without disregarding scientific criteria or placing herself above those interacting with the @energiewende.erklaert. Additionally, EMG acts as a multiplicator with @energiewende.erklaert by inviting and featuring scientists in videos who don't have experience with science communication or TikTok so far. @energiewende.erklaert offers a structured space for science communication, encouraging participating scientists to create their own profiles. From the perspective of post-normal science, the practices, roles and norms postulated in theory compared to the lived reality in @energiewende.erklaert show congruence as well as divergence in their manifestations. Particularly noteworthy is the general, almost incidental shift from the perceived pure researcher to a person with scientific expertise, but also their own opinion, context and emotions.

@energiewende.erklaert is an example of socially relevant science communication with a focus on asynchronous dialogue-based rather than monolog-based formats that allow questions and inspiration to flow back and thus not only brings science into the public discourse, but also opens it up and supports social change. This direct and proactive approach leads "from being the whistleblowers of the problem to being part of the solution" (Perga et al., 2023). Moreover, this type of science communication is a valuable alternative for communicating initial scientific findings in a low-barrier and fast way, which can be a further advantage for current topics and comparatively long publication processes. Regarding transdisciplinarity, @energiewende.erklaert also acts as a format to communicate together with societal actors which can lead to the co-creation of science communication formats.

6 Conclusion

Additional analyses that examine individual aspects further and incorporate empirical research are required for more detailed statements about the relationship between theory and practice. In order to further the understanding, more diverse and different channels on the topic of energy transition or other topics related to the climate crisis should be analyzed. Nevertheless, some initial conclusions for higher education can be drawn from the considerations presented here. As it is more and more important to engage in science communication, it is inevitable to educate students on how to communicate science (Kankaria et al., 2024), especially in the context of post-normal conditions. @energiewende.erklaert can serve as inspiration for students, doctoral candidates or scientists in various disciplines to prepare their research topics, studies and findings for social media. Cooperations between @energiewende.erklaert and students would allow students to practice how to prepare their research for the public and actively engage in social discourse while they are still studying. Another interesting research question in this regard would be which teaching and learning formats are suitable in university contexts and what additional skills teachers and students need to foster new science communication formats (Frick and Seltmann, 2023).

However, the fact that the amount of problematic comments EMG receives on videos is significant, i.e., a study found 41% problematic comments for a reference period (Grommes et al., 2025), also makes it clear that addressing scientific findings and

questions with the public requires courage and a strong stance from researchers. It also implies a need for institutional and peer support to keep going and not give in to push backs. Implicitly, this means that researchers who present their findings in social media need to be trained to deal with problematic feedback and to familiarize themselves with the ways of communicating in social media, which are often very different from traditional scientific discourse or exchange. At this point, it seems important to start directly with students to make them aware of the opportunities and challenges of transformative teaching and research as well as post-normal science through social media channels in the early stages of their qualification. Therefore, it takes more than the ability to tailor the content to a specific audience (Lehner, 2020) and methods of audiovisual presentation of scientific findings to create transformative science under post-normal conditions. Equally important are social skills, a redefinition of one's own role, resilience, a willingness to engage in discourse and a deep understanding of how social media works. There are still gaps around these issues in the current higher education curriculum that need to be closed (Wissenschaftsrat, 2021, p. 55). Communicators must not only acquire the skills described, "but also anticipate the impacts of their work" (Nogueira et al., 2021, p. 1).

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

This paper involves Eva-Maria Grommes and her TikTok account @energiewaende.erklaert as object of research for the case study. This study was reviewed and approved by the Research Ethics Committee of the University of Applied Sciences Cologne. Eva-Maria Grommes is one of the co-authors of this paper and hereby provides informed consent. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

CF: Conceptualization, Writing – original draft, Writing – review & editing. E-MG: Conceptualization, Writing – original draft, Writing – review & editing. AW: Conceptualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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