



Environmental Science Communication for a Young Audience: A Case Study on the #EarthOvershootDay Campaign on YouTube

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Addressing global sustainability challenges such as climate change in democratic societies requires thorough political and societal debates. Science and environmental communication is needed to inform these debates. However, not all parts of society are equally reached by traditional science communication. In particular young people, especially without academic background, are often left out. The cooperation of science communicators with influencers on the video platform YouTube can be a way to convey scientific information and raise awareness for environmental issues with new young audiences. This case study looks at three videos from the campaign #EarthOvershootDay on YouTube by the WWF (World Wide Fund for Nature) Germany and the educational initiative MESH Collective. The focus of the analysis lies on the established success factors of communication through influencers—specifically authenticity, comprehensibility and storytelling—and how they play out in detail in the three exemplary videos. Besides the analysis of the videos, the study is corroborated by interviews with the producers and a comment analysis in order to include the perspective of the viewers. Our analysis confirms previous findings on science communication with influencers and illustrates the practical implementation of these findings. It shows that authenticity is a central aspect which is not disturbed through the presentation of scientific content. The storytelling approaches are tailored to the respective influencer and their style. The language and structure of the videos are simple and comprehensible, scientific arguments focus on selected aspects and are tied to examples from everyday life. The comments by the users support these findings with the majority of comments addressing the three aspects of our analysis being positive. However, evidence for an in-depth engagement with the scientific contents could not be found in the comments. The stated goal of the campaign to reach educationally disadvantaged young people was only reached to a limited degree according to the assessment of the producers. Additionally, the views of two of the three videos remained below the average for the respective channel. Taken together this indicates that cooperation with influencers might not be an “all-purpose tool” guaranteeing success for science communication.

Keywords: youtube, science communication, climate change, sustainability, influencer, environmental communication

INTRODUCTION

Scientific issues lie at the core of many current societal and political debates (Weingart, 2011)—probably most prominently in recent years climate change. Science communication plays an important role in providing information for the public, thus facilitating these debates, and contributing to opinion-forming (Thomas and Durant, 1987). However, not all parts of society are reached by traditional science communication formats (Schrögel et al., 2018; Humm et al., 2020). One of these groups are children and young people. While 12- to 19-year-olds are referred to as a “challenging-to-engage” group for informal science learning offers (Lloyd et al., 2012, 25f.), they are at the same time an important target group for science communication—even more so for environmental communication—as the future generation (Marris, 2019).

While there has been much talk about the darker sides of YouTube—such as the spreading of conspiracy myths or climate change denialism (Basch et al., 2017; Hussain et al., 2018; Paolillo, 2018; Allgaier, 2019; Ekram et al., 2019)—this article sheds some light on a brighter side of the video platform: the potential of YouTube as a tool for science communication to reach and engage young people.

The video platform YouTube plays an important role in the learning habits of today’s young people (Jebe et al., 2019). While there already is a plethora of videos on YouTube addressing climate change, previous studies show that the (educational and visual) quality widely varies (Allgaier, 2019). If environmental science communication wants to reach young people in this variety of competing offers, new strategies need to be devised. Following the combination of science communication and popular culture (Allgaier, 2017), one such strategy can be the cooperation with established YouTubers as influencers, something already common in marketing (Brown and Hayes, 2008). This article uses the influencer campaign #EarthOvershootDay¹ on YouTube as a case study to investigate the characteristics and the potential of such web videos to reach young people with environmental communication. The campaign was produced by the educational initiative MESH Collective² in cooperation with WWF (World Wide Fund for Nature) Germany and nine established German YouTubers. It deals with the overall topic of sustainability and is especially aimed at young people.

¹The so-called Earth Overshoot Day is part of an annual campaign by the NGO *Global Footprint Network* and its partner organizations, including the WWF. It “marks the date when humanity’s demand for ecological resources and services in a given year exceeds what Earth can regenerate in that year” (Global Footprint Network, 2020).

²MESH Collective was founded in 2010 under the name “DU HAST DIE MACHT” by the Robert Bosch Stiftung and the film and production company UFA. Since then, it has been dealing with the extracurricular digital education of young people who are less interested in politics and education (von Kempis, 2016, 34). The education initiative develops video campaigns for its clients (e.g., foundations, NGOs, ministries) for YouTube, with a focus on knowledge transfer to specific target groups (MESH Collective, n.d.). Today, MESH Collective is a brand of Divimove GmbH which is part of the RTL Group, an international media company based in Luxembourg.

The case study focuses on the three aspects of authenticity, comprehensibility, and storytelling when communicating through influencers. Authenticity can, on the one hand, be part of the linguistic design (e.g., use of youth language) and on the other hand be transported through further levels such as the setting, facial expressions, and gestures, or the type of argumentation. Comprehensibility for and appeal to young people can be achieved by everyday language, a comprehensible structure, visualizations as well as an appealing narrative style (storytelling). The question of the case study is, how these factors manifest themselves in the video material, how the production process works and potentially influences the video design, and how the videos are perceived by the audience. Specifically, one key aspect is if influencer communication with scientific content is perceived as inauthentic.

In order to gain insights into the characteristics of the videos, we conducted a qualitative content analysis of three of them. Additionally, interviews were conducted with the responsible persons at MESH Collective, the WWF as well as one of the YouTubers to gain insights into the production process and its evaluation. Furthermore, to include the perspective of recipients, the comments on the selected videos were subjected to a quantitative content analysis.

THEORY AND BACKGROUND

Engaging a Young Audience With Science and Environmental Communication on YouTube

While children and young people are for quite some time being addressed specifically by science communication in an educational context and through approaches to increase the number of students in STEM (science, technology, engineering, and math) subjects, these efforts most often focus on activities such as school workshops, open laboratories or science festivals (Rennie, 2014). With the focus on attracting potential future students, many activities concentrate on pupils in academically oriented secondary education. Furthermore, students’ engagement and identification with science is influenced by existing social inequalities (Archer et al., 2012).

The usage of the video platform YouTube might offer the possibility to engage with young people and, thus, to address these limitations with science and environmental communication outside the school context. YouTube is the second most visited website globally (Alexa, 2020), and according to a representative survey almost two-thirds of 12- to 19-year-olds in Germany consider YouTube as one of their favorite Internet offerings. Almost all respondents (90%) used the platform at least several times a week. After search queries via Google, YouTube is their most important research tool, with 55% using the platform regularly for information search (Feierabend et al., 2020, 27, 38, 41). Furthermore, people not only watch videos on YouTube, but commenting and rating of the videos play an important role as well (Geipel, 2018, 140).

Regarding issues and interests, environmental protection and problems are a present topic for young people in Germany.

Although they see themselves as responsible, they also address their negligence, e.g., in waste avoidance (Calmbach et al., 2016, 272). However, awareness and interest in environmental issues are strongly influenced by social status and inequalities. This can be seen when looking at participation in the Fridays For Future (FFF) movement as an example. A study on the participants in climate protests in March 2019 in 13 European cities found that “[a]mong FFF-protesters, too, the highly-educated parts of society are overrepresented. School students attending the FFF demonstrations definitely have a well-educated family background” (Wahlström et al., 2019, 10).

Looking beyond that, especially at the milieu of *materialistic hedonists*³, one can see that many are afraid of being conspicuous as “tree huggers” due to too much interest in environmental protection. If at all, their interest focuses on specific everyday examples, such as saving energy, rather than the global context. They are strongly oriented toward what the majority is doing (Calmbach et al., 2016, 267, 272).

With regard to specific actions for climate and environmental protection, young people especially from this milieu assess their effectiveness as low. Compared to environmental protection, climate change is seen as something that is far away and takes place on other continents. Accordingly, fewer are willing to get involved in this. Many young people also lack knowledge about the larger context of climate change or what they can do in concrete terms. Especially those with low formal education are indifferent to the topic and do not see climate change as too problematic (Calmbach et al., 2016, 277–284).

The term “critical consumption” is little known among young people in Germany, but the debates about it, e.g., questionable production conditions, are. Materialistic hedonists in particular “actively name the production and distribution problems of cheap fashion brands” (Calmbach et al., 2016, 287), but do not want to change their behavior, as price and appearance are more important to them than fair production conditions (Calmbach et al., 2016, 294).

In summary, there seems to be a growing interest in sustainability issues and the topic is also seen as important—although this is varying with educational and social backgrounds. One common challenge for young people, in general, is that there apparently still is a lack of low-threshold information and tips for concrete action.

At the same time, the issue of sustainability has been gaining a lot of attention on YouTube in recent time, as is evident in the YouTube Trends Snapshot for the first quarter of 2019 (Pettie, 2019). However, while web videos are now regularly used for science and environmental communication, research on it is limited (Allgaier, 2016, 19; Geipel, 2018, 150) as the main focus of content research still focuses on print media (Schäfer, 2017, 282f.).

³Materialistic Hedonists are one of several milieus from the Sinus Youth Study. They are the “leisure- and family-oriented lower class with pronounced brand-conscious consumer desires” (Calmbach et al., 2016, 91). Mostly they have low formal education. On television, they follow entertainment formats such as talk and reality shows or infotainment. Girls in particular like to follow the lives of stars in the media. They are usually not interested in further education outside school, so as not to be considered as “nerds” (Calmbach et al., 2016).

As a component of popular culture, the content on YouTube influences how science and scientists are perceived by the public (Allgaier, 2017, 242). This is both a potential and a risk. On the one hand, science YouTubers can positively change the public’s perception of science, on the other hand, could YouTube very well also be an “El Dorado for conspiracy theorists” (Allgaier, 2016, 20). This makes it all the more important for serious content to become more established. However, scientific institutions, in particular, have not been very active to date with regard to online (moving image) formats (Schäfer, 2017, 279). This is reflected in the observation that YouTube channels without a direct connection to scientific institutions seem to have a much greater reach than those from such institutions (Boy, 2020).

With regard to potential audiences, the evidence also confirms that YouTube can be a suitable channel to engage young people with science, as illustrated by a representative survey from Germany: 42% of the 14- to 29-year-olds reported that they use YouTube either frequently or very frequently to inform themselves about science and research online (Wissenschaft im Dialog, 2018, 76). This finding is in line with other studies that show that YouTube plays an important role as information source and learning tool for school content (Jebe et al., 2019, 55; Feierabend et al., 2020, 40).

Analysis Dimensions–Relevant Components for Science Communication With Younger Audiences Through Web Videos

When communicating science with children and adolescents, appealing examples as well as an understandable, not “too scientific language” are important to avoid a gap between “knowledge authority” and the target group (Marschalek and Schrammel, 2017, 15). Additionally, guidelines for science communication with underserved audiences can be useful. Common recommendations are, that science communication activities should be relevant for the audiences, take place at locations they normally use—including virtual places like YouTube—, in cooperation with persons or organizations they can relate to or have established connections as well as seeking to reduce the distance between communicator and audience (Humm and Schrögel, 2020).

In comparison to television, the sender, the context, as well as the target audience and its handling of social media in online environments are of greater importance, since new videos are constantly being suggested at the edge of the screen and the audience could click away at any time. A precise knowledge of the target group and the respective platform is, therefore, necessary for the production of successful scientific web videos (Krachten, 2016, 29).

Entertainment plays an important role for web videos. The typical intro serves the dramaturgical structure of the video; it must be directly clear to the viewer why it has to be watched to the end and should be as short as possible. The outro at the end of the video should lead to further videos via links, usually it

also contains an invitation to subscribe (Krachten, 2016, 29–31; Muñoz Morcillo et al., 2016a, 124).

Going beyond these more general findings, three factors seem to be particularly relevant for science communication with a young audience: authenticity, comprehensibility and storytelling.

The Role of Authenticity

Authenticity is an essential feature of successful web videos. The YouTuber must make the format “his/her” format: “The young target group loves real people who act authentically. [...] The presenter must be on fire for the program” (Krachten, 2016, 28).

Two elements seem to be central for authenticity. On the one hand, a familiar face that presents content in a credible way (Welbourne and Grant, 2016, 715), and on the other hand the means of expression used to present this content, for example by filming at “workplaces that seem authentic” or “everyday clothes and everyday language” (Breuer, 2012, 105f.).

Subsequently, two aspects of the components contributing to the perceived authenticity of a video are described more in-depth: influencers as authentic and familiar faces for their peers and the role of everyday language, particularly youth language, as a specific component of expression.

Authentic and Familiar Faces—Influencers

Well-known YouTubers can act as trusted intermediaries between the provider and the audience. The early concepts of using influencers—influential people in their respective local or peer communities—for marketing did not consider social media to be the most important aspect (Brown and Hayes, 2008, 166). But with the exponential growth of social media platforms and users worldwide, today influencers are primarily seen as a digital phenomenon (Seeger and Kost, 2018, 13–15).

Empirical studies confirm that the authenticity, more specifically being relatable to, as well as the appeal of influencers create their value for marketing: “(...) influencers’ trustworthiness, attractiveness, and perceived similarity (to their followers) positively influenced their followers’ trust in their branded posts” (Lou and Yuan, 2019, 68). This is confirmed for social media in general as well as for YouTube influencers in particular (Xiao et al., 2018).

These mechanisms can also be used for science and environmental communication. Welbourne and Grant (2016) have shown that user-generated science communication content with a continuous presenter (as the face of the video/channel) is more popular in comparison to professionally generated content, e.g., by science institutions—although today’s influencers can be considered professionals, especially with respect to video production methods and technology. Muñoz Morcillo et al. (2016b) found in a content analysis of 200 popular science web videos that the videos are mostly shot by amateurs, but that professionalization is taking place. This development has been confirmed in a follow up study (Muñoz Morcillo et al., 2019).

The cooperation with influencers allows educational content to reach other audiences (von Kempis, 2016, 35), although one has to consider questions of credibility, quality, and ethics, especially for areas such as health communication (Altendorfer, 2019)—influencers can have a considerable impact within their communities but also reaching beyond that as the case of the

YouTuber Rezo has shown. He triggered a nationwide debate on politics and climate change in Germany with one video attacking the conservative party (Allgaier, 2020).

Authentic Expression—Youth Language

Youth language as a variety of language like dialects or technical language (Femers-Koch, 2018, 112) can be defined as an “orally constituted medium of group communication used by young people in certain situations” (Neuland, 2018, 90). In general, youth language facilitates information exchange on eye level and functions as a show of solidarity and belonging to a certain social group and distinction to other groups. On the individual level it can also be part of developing and expressing identity and lifestyle (Bahlo et al., 2019). Thus, is it not surprising that in advertisement youth language is used “to establish proximity to the target group” (Femers-Koch, 2018, 116) and to enable a direct and emotional address. It has to be noted, that this approach is not seen uncritically: “Popular formats for the youth rarely offer authentic role-models with positive potential for development, but rather archetypal narratives and stereotypic language, that can be marketed more broadly [regarding >>culture industry<< see Horkheimer and Adorno (2006)]” (Bahlo et al., 2019, 108).

According to Bahlo et al. (2019, 55–77), youth language can be identified by several features, for example by their morphology, the usage of anglicisms, and the influence of different domains like media, fashion, or sport. For this study, terms were classified as youth language if they were marked as youth language in the German dictionary *Duden* or—depending on the context—anglicisms.

The Role of Comprehensibility

Good comprehensibility serves to keep the cognitive load of the stimulus as low as possible and thus, according to the so-called *Limited Capacity Model* (Lang, 2000)⁴, promotes information processing and knowledge transfer.

So far, comprehensibility in science communication has been investigated primarily for texts (Langer et al., 2011) and in the audiovisual sector for scientific TV reports (Milde, 2009; Lauter, 2018). However, the comprehensibility of scientific web videos has not yet been specifically researched.

Three studies show several characteristics that influence the comprehensibility positively—following the Hamburg Comprehensibility Model (Langer et al., 2011): simplicity (e.g., language, visualizations), structure, brevity, and stimulating features (e.g., examples, storytelling, personalization, emotions) (Milde, 2009, 126, 137, 245; Langer et al., 2011, 21f.; Lauter, 2018, 416).

The Role of Storytelling

One method that serves to improve comprehensibility is storytelling. This means that the information to be conveyed is presented in narrative form (Früh et al., 2014, 46).

⁴According to the *Limited Capacity Model* (LCM) the human brain’s cognitive capacities for encoding, saving and retrieval of information are limited. The information processing is influenced on the one hand by the recipient (*cognitive effort*) and on the other hand by the stimulus (*cognitive load*). In order to influence the information processing positively, one has to reduce the cognitive load while at the same time increase the attention.

TABLE 1 | Overview on the three videos analyzed in the case study.

Video title	NiksDa–Kein Thema (prod. Dalton) #EarthOvershootDay	NACHHALTIGKEIT and KLEIDUNG–Tipps für Einsteiger #EarthOvershootDay	Plastic in Paradise–mein Urlaub im Müll #EarthOvershootDay
YouTube channel	<i>NiksDa</i>	<i>Typisch Sissi</i>	<i>Dillan white</i>
Number of subscribers (channel)	127 000	251 000	365 000
Average views per video (channel)	90 650	38 659	156 785
Date	18.01.2019	07.11.2018	13.09.2018
Length	05 m 18 s	09 m 02 s	07 m 11 s
Views	125 293	15 322	29 821
Likes/Dislikes (ratio)	12,330/375 (32, 88)	785/20 (39, 25)	3,982/16 (248, 88)
Number of comments	1,057	87	221
Video URL	https://www.youtube.com/watch?v=Fwz4T63IHmA	https://www.youtube.com/watch?v=iwhe6qtTP9k	https://www.youtube.com/watch?v=Ja1JSLQGDr8
Abbreviation	video_nd	video_ts	video_dw

Number of subscribers, views as of 06/29/2020 and comments as of 02/11/2020. The average number of views per video were determined with the help of the R package *tuber* in version 0.9.9 (Sood, 2020).

Communication scholars characterize narratives by a mediating instance (narrator) that selects the events, puts them in perspective, and unfolds them in a temporal structure (Früh et al., 2014, 46–50; Metten et al., 2016, 110). By presenting the messages from an individual perspective (of the narrator or fictional characters), the audience can identify with them more easily (Dahlstrom and Scheufele, 2018, 1). Storytelling is about creating tension, empathic participation, and/or curiosity, which is usually achieved by a pictorial narrative (Früh et al., 2014, 46f.).

Narrative thinking “is thought to represent the default mode of human thought” (Dahlstrom, 2014, 13615). It presents itself as an evolutionary advantage since it enables people to imagine different possible realities and thus to better predict cause-and-effect relationships and to put themselves in the position of others (Dahlstrom, 2014, 13615). Accordingly, the narrative mode is also more common in everyday life than the descriptive-argumentative mode (Früh et al., 2014, 63). Storytelling thus offers great potential for the communication of scientific content, especially by linking it to the recipients’ world of experience. Empirical studies have shown a higher recall rate, better comprehensibility, and shorter reading times for texts (Dahlstrom, 2014, 13615; Früh et al., 2014, 166).

An analysis of web videos shows the distinct talent for storytelling and personalization of YouTubers, describing it as probably the most important aspect of these videos (Muñoz Morcillo et al., 2016b, 20f.). Thus, liveliness, passion and creative storytelling are essential elements (Krachten, 2016, 29f.). Most of these characteristics apply to the typical approach and style of many influencers, and the presentation from a narrator’s perspective itself has a close connection to the factor *authenticity* described above.

CASE STUDY VIDEO MATERIAL

In this case study a concrete example of the cooperation with influencers is examined: The video campaign #EarthOvershootDay on YouTube. The German education

initiative *MESH Collective*, together with the *World Wide Fund For Nature (WWF)* and the *Robert Bosch Foundation*, facilitated the production of nine videos in cooperation with established YouTubers for a campaign on environmental topics. While the *Robert Bosch Foundation* financed the campaign, the WWF was responsible for the scientific contents and *MESH Collective* coordinated the video production.

The video campaign consists of videos with a length of 5 to 15 min, published between 1st August 2018 and 29th July 2019. The campaign aimed to sensitize young people for the issue and show them possible courses of action (Robert Bosch Stiftung).

Three of these nine videos were randomly selected and analyzed in detail. **Table 1** shows the three videos selected for the analysis; a detailed scene protocol can be found in the **Supplementary Tables 2–4**.

The first video was produced together with the YouTuber Niklas Kolorz, who acts under his stage name *NiksDa* and operates an eponymous YouTube channel. Accordingly, the video is referred to in the study with the abbreviation *video_nd*. The video deals with the topic of meat consumption. The first and at the same time the main part of the video (00:00–04:39) consists of a music video with its typical structure: instrumental intro, insertion of interpreter (*NiksDa*) and title (“Kein Thema” [“Not an issue”]) as well as three times verse and chorus. The setting is an Italian restaurant. A young man (played by *NiksDa*) invites a woman (played by another well-known YouTuber—Sina aka *Fräulein Chaos*) for a date. When she wants to order a steak, the subject of meat consumption comes up. Alternating the two of them bring up their arguments for and against meat consumption. In the chorus, which also forms the conclusion, the tabooing of the topic is addressed. In the second part of the video, *NiksDa* welcomes the viewers and invites them to comment, subscribe, and rate.

The second video was produced together with Sissi Kandziora, whose channel name is *Typisch Sissi* and who is known on YouTube as *Sissi*. Her video is abbreviated here with *video_ts*. In the video *Sissi* is sitting on a sofa in her apartment

and tells the viewers tips and possible courses of action on how they can deal with clothing in a more sustainable way. In doing so, she draws a connection to her past, i.e., her “shopping addiction,” as she says, and gives some (scientific) arguments on the subject of clothing consumption. In the run-up to the event, she conducted a Skype interview with the scientist Samira Iran, of which she uses cutaway images (without sound). For the interview, she created a separate video.

The third video was produced together with Dillan White. His channel carries his name, but with a dot at the end: *dillan white*. Thus, we refer to the video with the abbreviation *video_dw*. For the reportage style video Dillan White traveled to Croatia and shows the problems of plastic waste in seas and oceans in his video. He meets with the “Meeres-Verbündeten” (“sea allies”) of the WWF youth and collects plastic waste together with them. He reports about his experiences and reinforces his impressions with scientific arguments.

The channels of these three YouTubers each have very different thematic focuses and correspondingly their own target groups. The channel *NiksDa* has been very much concerned with gaming and music videos in the past. The channel also features vlogs (video blogs), self-experiments, travel videos, and a knowledge series “Verstandgebläse” [roughly “mind blower”]. Niklas Kolorz has meanwhile retired from the gaming sector as he announced in various comments on his channel.

Sissi Kandziora’s channel *Typisch Sissi* focuses mainly on topics like cleaning and tidying up. She always shoots her videos from home and shows how she sorts things out, rearranges rooms, and gives useful everyday tips on how to live more “consciously.” On her website, she describes her values with authenticity, honesty, sustainability, natural ingredients, and fair production. According to self-reported information, about 85% of her followers are female and most of them (70%) are between 18 and 34 years old (Kandziora, 2020).

Dillan White, at 21, is the youngest of the three YouTubers and has not yet dealt with sustainability issues on his channel. He deals with fashion and lifestyle, travel, “stupidities,” challenges, and music. No further information on his target group could be found apart from the statements made in the interviews. The producers estimated that it is aimed more at younger, less formally educated, and consumption-oriented viewers (JA)⁵.

METHODS

This study explores what characterizes the three analyzed videos of the #EarthOvershootDay campaign and their assessment through producers and viewers as well as how these findings could be relevant for the broader question, how scientific and environmental topics can reach a young audience through the cooperation with influencers on YouTube. In order to do so, three methods were triangulated: a qualitative content analysis of the videos, guided interviews with producers and one of

TABLE 2 | Overview on the interviewees for the production perspective.

Name	Institution/role	Initials
Julia Althoff	Head of MESH collective	JA
Nikolas Kappe	Senior editor at MESH collective	NK
Tina Harms	WWF, consultant for digital education	TH
Sissi Kandziora	YouTuber <i>Typisch Sissi</i>	SK

the YouTubers, as well as a quantitative content analysis of the comments.

Guided Interviews With Producers

The producers were interviewed to gain insights into the production process and especially their strategies and motives. The semi-structured phone interviews were conducted and recorded in April 2019 and lasted between 30 and 50 min. Interviews were conducted with representatives from the organizations behind the campaign as well as the YouTuber *Sissi* (see **Table 2**). The other two YouTubers from the selected videos, *NiksDa* and *Dillan White*, were not available for an interview at the time of data collection.

An interview guide with five categories was used for all interviews and the coding of the answers: target group, project execution, aims and purposes, strategies and design tools, and assessment of the campaign’s success. The subcategories for further analysis were formed inductively (see **Supplementary Table 1**).

By interviewing several people, a multi-perspective picture was obtained, which can be related to the content analysis of the videos, e.g., to what extent aims and intentions and the strategies correlate with the actual video design. The questions about the project execution and assessments of its success serve as a first classification of how well the project worked. The transcripts of the interviews were also evaluated by content analysis using the above-mentioned categories.

Qualitative Video Analysis

For the examination on stimulus level a scene protocol (see **Supplementary Tables 2–4**) was made for each video to investigate the visual aspects. This together with transcripts of the videos provided the basis for the qualitative content analysis (Kuckartz, 2018).

The hierarchical category formation was deductive-inductive. The three main categories for the analysis of the videos were authenticity, comprehensibility, and storytelling. The subcategories emerged partly deductively from the theory and partly new subcategories were formed inductively based on the material. The entire category system for the analysis of the video transcripts is shown in **Table 3**. Suggestions for the categories were provided by the works of Milde (2009), Langer et al. (2011), Breuer (2012), Dahlstrom (2014), von Kempis (2016), Krachten (2016), Muñoz Morcillo et al. (2016b), Welbourne and Grant (2016), and Lauter (2018).

The category “Authenticity” comprises two dimensions. Firstly, how convincingly the YouTuber presents the respective

⁵The quotations are from the interviews with the producers conducted for this study. The abbreviations stand for the respective interviewees (see **Table 2**).

TABLE 3 | Category system for the analysis of the video transcripts.

Authenticity	Comprehensibility	Storytelling
<ul style="list-style-type: none"> • Youth language • Setting • Argumentation <ul style="list-style-type: none"> ◦ Adherence to scientific arguments ◦ References to youth lifestyle ◦ Facial expression and gestures 	<ul style="list-style-type: none"> • Everyday language • Technical terms • Complexity of the sentences • Structure of the video • Visualization techniques 	<ul style="list-style-type: none"> • Emotionalization • Concrete examples • Personalization • Involving the audience

For this analysis, “scientific arguments” are presented aspects that can be concrete numbers or other data, theories and models/explanations as well as science or knowledge-based issues and background information.

topic. This is operationalized with the argumentation as well as some elements of storytelling. On the other hand, how authentic the staging is, which is operationalized by the use of youth language and the setting.

For the categories “Comprehensibility” and “Storytelling,” the *Hamburg Comprehensibility Model* was used. The subcategories for “Storytelling” are mainly formed based on Früh et al. (2014) and Dahlstrom (2014). The categories are not disjunct. Some categories that are assigned to comprehensibility also play a role in authenticity and vice versa, e.g., everyday language or the type of argumentation.

Quantitative Content Analysis of Comments

The viewers’ perspective on and their assessment of the videos are included through a quantitative analysis of the comments on the three selected videos to evaluate the outcome with respect to the producers’ strategies and aims.

A snapshot of all comments was downloaded at 02/11/2020. Comments by the YouTubers on their own videos were excluded from the analysis. Thus, out of 1,366 comments, 35 were excluded from the actual analysis. The rest were coded in three categories, which are slightly different to the three main analysis dimensions to better capture the audience perspective:

- **Topic Choice**
Comments addressing the chosen topic or focus of the selected aspects within the video and/or the overall topic area of sustainability, environment or similar overarching areas related to the respective content.
- **Comprehensibility**
Comments addressing the comprehensibility, especially with respect to the (scientific) information within the video (e.g., models and theories, data, sources).
- **Presentation Style**
Comments addressing the presentation style in the video, including setting/location, speech, acting and performance, visuals, sound effects, cut or other aspects.

Each category has four possible manifestations:

- Negative comment criticizing the category’s aspect
- Comment with both negative and positive aspects regarding the category’s aspect
- Positive comment lauding the category’s aspect
- Aspect not mentioned.

Each comment was coded independently by two people. The codings were then compared and in the case of differences a consensual solution was agreed on—so-called “consensual coding” (Hopf and Schmidt, 1993, 61–63).

RESULTS AND DISCUSSION

The Production Perspective on the Campaign

The Campaign’s Target Group

According to the producers, the campaign was aimed at the age group of 16- to 24-year-olds. Initially, the focus was on reaching educationally disadvantaged young people, which was still an important target group, however, this shifted later on toward a more mixed audience. Tina Harms explained that the Sinus Milieu studies were used as a point of orientation, and that the main target group were *materialistic hedonists* and young people who “have not yet come into contact with science” (TH). Ultimately, however, young people with an affinity for education should also be reached. The producers wanted to make sure that the channels’ “communities have as different focal points of interest as possible” (JA).

Sissi Kandziora described her viewers as mainly older than 20 years, “open to the topic” and said that many are rethinking through her channel (SK). However, this would not be the broad mass but “the reasonable ones, who also want to think further and educate themselves” (SK).

The Production Process

Within the campaign, MESH Collective was responsible for the editing and production of the videos and formed a bridge of communication between YouTubers and scientists. They were also responsible for selecting the YouTubers. On the one hand, they selected YouTubers, with whom MESH Collective had already worked together, and on the other hand, new ones were picked, “who are active in the classic gaming, make-up, travel sector—to match their followers a bit to the “consumer hedonistically” oriented” (TH), so that the channels are diverse in terms of interests.

The WWF provided the scientific content in the project and organized a workshop with young people and scientists in the run-up to the project. There they worked out which topics the young people find exciting. The participants were recruited via Twitter messages from the YouTubers as well as via school mailing lists and social services. Together with the WWF and MESH Collective, scientists then produced fact sheets with the most important information on the topic ideas.

The YouTubers met at a workshop to discuss the topics in-depth and decide which topic best suits them and their channel so that they can convey the topic authentically. Scientists were also present at this workshop. Scripts for the videos were created

by the YouTubers themselves, and they needed to write them in their language and style. If desired, MESH Collective offered support, e.g., in creating animations or searching for locations. The finished scripts were finally scientifically reviewed by the WWF and the YouTubers received feedback on their concepts.

Objectives of the Campaign

The producers named two main goals of the campaign. First, MESH Collective wanted “to place the issue of climate change in communities, such as Dillan White’s, which are all about fashion, to create awareness. [...] And to give help close to everyday life” (JA). The second was the sponsor’s—the Robert Bosch Foundation—goal of getting young people interested in science. This involved primarily reaching out to young people “whom we would not have reached otherwise” (NK), as well as “to initiate a dialogue between scientists and YouTubers and young people” (TH). Achieving a change in attitude and behavior was also desired, however, it was not the primary goal, but rather the “cherry on top” (TH). Sissi Kandziora stated that she mainly wanted to draw attention to the topic as she “had just become very interested in the topic of sustainability, as she used to consume a lot” (SK).

Strategies for the Video Production

The strategies mentioned in the interviews to achieve these objectives can be classified at two different levels: On the one hand, structural factors concerning the choice of platform and the concept, and on the other hand, the way the topic is presented in the videos. With regard to the former, Julia Althoff, for example, emphasized that they deliberately chose YouTube because moving images are—in her opinion—particularly suitable for conveying information and are clicked on more often. In addition, the cooperation between MESH Collective, YouTubers, and WWF would have enabled synergies. The presentation of the topics by the YouTubers themselves would have enabled optimal access to the target group. While MESH Collective would have supported the YouTubers in preparing the contents in a journalistically sound manner and the WWF would have provided scientific information (JA). From Tina Harms’ point of view, positive effects can be achieved with the target group by using new formats such as the rap video by *NiksDa*. Sissi explained that she also paid attention to video length and short intros.

Concerning the video design, all interviewees emphasized (sometimes several times) the importance of authenticity. The secret is,

“that we use the creativity and what the YouTubers have built up to convey our content, and that we use the language at the same level as the young people” (NK),
 “that the video doesn’t drop out of the channel scheme, i.e., doesn’t disturb the viewing habits; that we observe very closely with the YouTuber, what works on the channel and embed it in the program scheme, what formats are already on the channel and prepare the video accordingly” (JA),
 “that the YouTubers could authentically convey a theme in their way, but they were also convinced of it themselves.” (TH)

The YouTubers were accordingly given a “freehand” (NK) in the design. The close cooperation with the YouTubers and the trust in their work, as well as the intensive contemplation of the target group were seen by the interviewees as a central strategy of the project, e.g., through the abovementioned workshop. When preparing the information and producing the videos, care was also taken to establish a connection to the life world of the recipients, which the YouTubers would easily achieve through their person alone (JA; NK; TH).

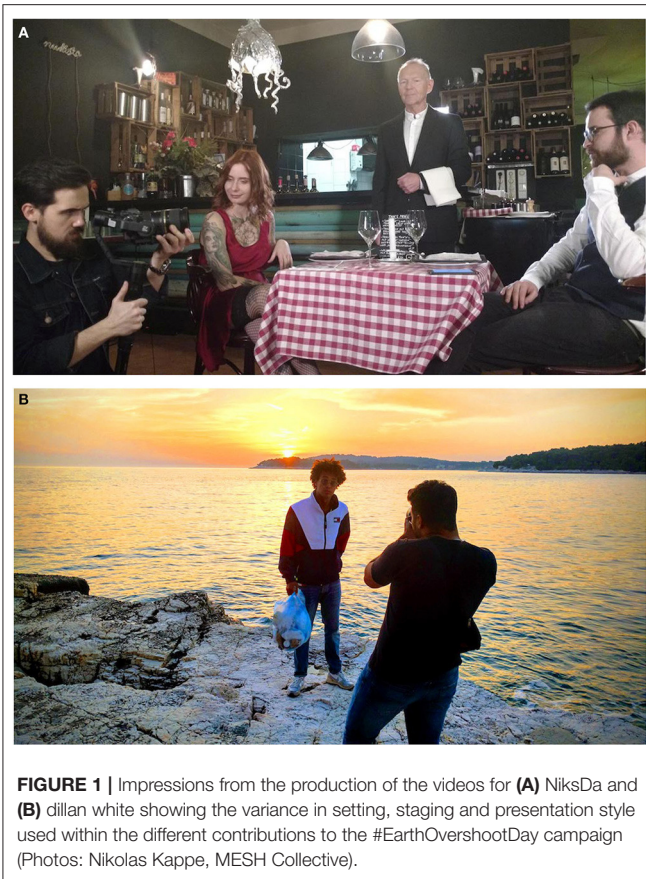
Besides authenticity, comprehensibility was a decisive factor and had to be adapted to the target group. The videos should not contain too much, but also not too little information (NK). The information should be conveyed in the videos rather casually and not with a raised forefinger (TH). Furthermore, the producers claimed that care was taken to ensure that the videos are comprehensible by using simple language, explaining technical terms, and, if necessary, using graphics. This was “always in the foreground” (JA) according to MESH Collective. Graphics or insertions also should make the video more interesting, as Sissi Kandziora emphasized. Nikolas Kappe explained that he paid attention to the tension and dramaturgy of the videos. After all, according to Tina Harms, it had to be also “somehow be a cool story,” referring to the importance of storytelling.

Encountered Challenges

The interviewees also reported challenges during project implementation. On the one hand, the support of the YouTubers was time-consuming, agreements had to be contractually agreed (JA; TH). On the other hand, the different interests and ideas of all actors had to be brought to a common denominator. The basic question in the project was: “What does science mean and how do you make that visible?” (TH) This was discussed and explored together within the team. The Robert Bosch Foundation as sponsor—who normally has nothing to do with YouTube—had to be persuaded at first, so that they “accept the slang and dynamics of YouTube” (JA). Also, especially “the scientists had to be very, very open to this format” (TH). Not least for this reason, it was also a challenge to “get scientists at all” (TH).

Thus, although the topic was “not met on all channels with the same level of interest” (JA), “discourses were initiated” on all channels, and awareness was created (JA). Besides, there were many positive comments below the videos and feedback also on corresponding Instagram posts (JA; NK; SK). Negative comments, which, for example, question the scientific sources, had not been noticed (NK). These impressions are corroborated by our quantitative comment analysis.

It is difficult to judge whether there has been a change in the viewers’ thinking or behavior, but this was not the primary goal of the campaign according to Nikolas Kappe and Tina Harms. She notes: “Many watched the video, many wrote a comment, but much less went to the landing page [of the campaign],” so there would still be room for improvement here. Sissi Kandziora, on the other hand, states that she received many messages from viewers who rethink through her channel.



Video Analysis

Authenticity

Use of Youth Language and Everyday Language

The analysis of the scene protocols shows that youth language was used very little in the videos, but everyday language is used in all videos. Only the music video by *NiksDa* contains some explicit youth language terms. Due to its genre, this video represents a special case. The language here is aligned to song lyrics of the genre hip-hop, to which this video is assigned, and therefore possibly contains more youth language expressions—however with only just 16 occurrences—than the other two videos. The two other YouTubers speak in a very natural way. Filler words and occasional “ums” [“ähms”] make the language appear authentic and natural.

Setting

In each of the three videos, the setting corresponds to the respective YouTuber, his or her channel, and the topic. Accordingly, the filming locations and the presentation differ substantially between the videos (see **Figure 1**).

The music video (*video_nd*) was shot in a Berlin restaurant. Most of the time the two main characters are shown at the table (e.g., scenes 7, 9, 11, 13, 15, 32). However, other people can also be seen in the restaurant (e.g., scenes 5, 35). All in all, the situation appears realistic, even if the actions are staged

and do not correspond to everyday actions (e.g., dancing in the restaurant during the chorus). This, however, corresponds to the video’s genre.

Sissi Kandziora shot her video (*video_ts*), like all her other videos, at home. In almost all scenes, she sits on a couch and talks in a private, homely atmosphere (e.g., scene 1). This gives a feeling of closeness as if the viewer is talking to a friend. According to Sissi Kandziora’s interview, this is also what she wants to achieve (SK).

The third video by Dillan White (*video_dw*) was filmed at several locations in Croatia, mostly on the beach, which gives a “holiday feeling” on the one hand. This is especially visible in the entrance scene. The beauty of the landscape is explicitly emphasized by filming at sunset (e.g., scene 1–3) or aerial shots (scene 5). On the other hand, this seemingly intact world is broken by the amount of plastic waste shown in the video. For example, shots of the huge garbage carpets on the sea (scene 4), numerous close-ups of the plastic waste (e.g., scenes 4 and 10), or when Dillan White visits a local garbage dump (scenes 7–10) illustrate the extent of the problem.

Argumentations

Each YouTuber in the analyzed videos uses his or her own story and way of argumentation to impart the topic to their viewers. *NiksDa* tries to convey the topic to the audience in the context of a dialogue story close to everyday life without being instructive. This can also be seen in the lyrics when he says: “No one changes their opinion in the shade of a raised index finger pointing at them” (TC⁶: 03:40). In the lyrics, he also admits that he does not want a “crusade,” but to make the importance of the issue clear: “But if nobody acts, climate change will win here in this country” (TC: 03:44). In the end, he leaves it open to the female protagonist Sina whether she eats meat, implicitly appealing to the responsibility of each individual. A final instruction for action is accordingly not explicitly given. However, the screeching noises of pigs and knife blades in connection with rapidly changing images (scene 50, TC: 04:03) shortly before the end of the song can be seen as a last emotionalizing argument that should make the audience reflect. In the second part of the video, in which Niklas Kolorz comments on the video, he refers to the link in the description for more information on the scientific arguments. He also calls for discussion in the comments but otherwise does not go into the subject in further detail.

In *Sissi’s* video, personal reference plays a particularly important role. She speaks to her followers as a peer by reporting about her personal experiences: “If you’ve known me for a while, you might know I used to be a shopaholic, and clothes were just fun for me” (TC: 00:19–00:27). In this way, she creates a connection to the viewer, who may also be able to identify with it. She then explains how she came to change her mind. In doing so, she emphasizes that she is making mistakes too: “Even today I am not free of mistakes. There are moments from time to time when I buy something that has not been produced fairly” (TC: 01:17–01:24). Overall, she does not present herself as an expert (e.g., TC: 01:47), which she also emphasized in the interview (SK).

⁶TC: time code.

She mentions a total of eight scientific arguments on the subject of sustainable clothing, which she does not simply string together, but closely links to her tips and her point of view. In doing so, she tries to use concrete examples to refer to the lives of young people, for example when she says: “Sure, if you want to buy a new shirt for a party every week, then that’s expensive. But if you buy a good quality shirt, where you know you’ll get something out of it, then it’s more sustainable” (TC: 05:17-05:26). With this, she appeals to the viewers to become aware of their values without directly prescribing anything to them—similar to Niklas Kolorz’ video. She explains that she has spoken with a scientist about the topic and also mentions the extra video for this, which underlines the soundness of her statements (TC: 02:04-02:21). At the same time, she wants to make the audience curious by saying: “I’m going to tell you a lot of things she told me” (TC: 02:21).

Of the three YouTubers, Dillan White makes the most use of scientific arguments. As in the other videos, the arguments are kept short and easy to understand. Most of all he emphasizes the amount of (plastic) garbage and that different animals eat it and die from it. He uses a very strong visual language, showing, on the one hand, the beautiful landscape, which thereby appears worthy of protection, and, on the other hand, the rubbish destroying this image. So, his last argument is: “The sea is so beautiful. And I personally want it to stay that way.” Likewise in the other arguments, his statements, but also his facial expressions and gestures suggest that he is much concerned by the subject, e.g., when he arrives at the garbage dump in scene 8: “And to look at this is just mega, mega gross” (TC: 01:17). His argumentation is based on the concrete examples of pollution, which are shown in the video and to which he takes a stance. He looks like he is shocked by the extent of the pollution. His conclusion—similar to the other two videos—wants to make the audience think, without putting them under pressure: It is “almost impossible to avoid producing plastic waste.” But you could at least “be a little more conscious about what you’re buying” (TC: 06:52).

Facial Expressions and Gestures

The facial expressions and gestures underline the argumentation of all YouTubers, as described above, and convey the emotions to the viewer. The facial expressions and gestures in *video_nd* are more pronounced due to the music format. Sissi Kandziora uses gestures the least. She talks calmly, matching the “sofa atmosphere.” Dillan White, on the other hand, gestures more and is also in his other videos more the slightly crazy, wacky type. He also uses his gestures to stage himself, for example by spreading his arms in the sunset (scene 1).

Comprehensibility

Language (Technical Terms, Everyday Language, Complexity of Sentences)

In all three videos there are only three terms that can be described as technical terms: “Fast fashion” (*video_ts*: TC: 04:02), “beach clean-ups” (*video_dw*: TC: 02:11) and “microplastics” (*video_dw*: TC: 02:30; 04:02). The first one is not directly explained in the video but is understandable from the context of what is being said: “You keep buying more and more and more. As a result, at some point, the wardrobe will overflow or the whole thing

will be disposed of in no time. Fast fashion” (*video_ts*: TC: 03:55-04:03). “Beach-Clean-Up” can be easily translated into the German “Strandreinigung” even with little knowledge of English. On the other hand, this term is also explained by the context and the images. Microplastics are mentioned twice in the video and explained in detail the second time.

The use of everyday language by the YouTubers includes deletions (“hab” instead of “habe” [have], “n” instead of “ein” [a]), clitics (merging of two words, e.g., “geht’s”), filler words (“ähm” [um]) as well as grammatical adjustments to the standard language (e.g., sentence order in the subordinate clause: “Weil ich habe das gemacht.” [because I did this]). In addition, colloquial terms such as “Karnickel” [pejorative for “rabbit”], “ratzfatz” [roughly “quickly”] or “krass” [insane] are occasionally used. All in all, this, together with the avoidance of technical terms and foreign words, not only improves the comprehensibility, but also the authenticity of the YouTubers, since their language is similar to the language of the target group.

The sentence complexity is kept simple in all three videos. The longest subordinate clause in *video_nd* consists of eleven words: “[...] sagt mir, wie euch das Video gefallen hat und wie ihr das fandet” [tell me how you liked the video and how you perceived it] (TC: 05:04). Within the lyrics, the two longest subordinate clauses each have only eight words. A large part of the subordinate clauses consists of filler words (in italics in the example): “[...] weil ich sowas *auch wirklich echt scheiße* finde” [because I also just really find that crap] (TC: 03:36). Often there are also constructions with “und” as in the first example. Sissi Kandziora in particular uses a lot of main sentences that she associates with “und”: “Wir leben komplett über unseren Verhältnissen und ich seh momentan keine Grenze [...] Deswegen wollt ich heut’ einfach mal so n alltägliches Thema wie Kleidung aufgreifen hier in meinem Video und Frau Iran [the scientist] hat mir zum Beispiel auch eine Zahl genannt [...]” [We are living completely beyond our means and I don’t see any limits at the moment [...]. Therefore, I would like to pick up an everyday topic such as clothing for my video and Mrs. Iran [the scientist] for example also gave me some numbers] (*video_ts*: TC: 03:13-03:28). Dillan White uses very few subordinate clauses and when he does, they are kept short and simple.

Structure of the Videos

All three videos can be divided into the typical three main parts intro, main part, and outro. At the beginning there is an introduction where the topic and, if necessary, the location is introduced. However, the music video by *NiksDa* represents a special case. The greeting comes after the video and the theme only becomes clear as the song progresses. In all three videos, the scientific arguments are mentioned in the main part bit by bit. At the end of *video_nd* and *video_ts*, the typical YouTube references to links in the infobox for further information, the request to viewers to write comments, and the outro take place. *video_dw* dispenses with this and ends instead with a call to pay attention to one’s plastic consumption. The clear and simple structure, that is typical for the platform and the respective channel, supports the comprehensibility of the videos.

Visualization Techniques

Neither *video_dw* nor *video_nd* does contain any graphics or diagrams. In *video_nd*, the visualization is achieved primarily through the acting persons themselves, through their facial expressions and gestures as well as individual elements such as the apple in scene 33 or the smartphone in scene 18, which shows Sina's profile photo on the dating app Tinder including two rabbits. In addition, the problem of meat consumption is presented with some still images, e.g., from within a slaughterhouse, in scene 50.

In *video_ts*, Sissi Kandziora uses some flashbacks from earlier videos to illustrate her past. Also excerpts from her Skype interview with the scientist Samira Iran as well as animated graphics lighten things up—so that Sissi's face is not the only thing visible the entire time as she said herself. This makes the video not look boring, and the most important scientific arguments can be clarified by the graphics.

In *video_dw*, Dillan White worked mainly with landscape images and images of the waste pollution on the beaches. He also used aerial and underwater shots, opening up dimensions to the viewer that usually are not visible. In all three videos, the visualizations serve to support what is being said and do not diverge from the verbal message, thus, enhancing comprehensibility.

Storytelling

In all three videos, forms of storytelling are used, but in different ways. Niklas Kolorz unfolds the theme of meat consumption with his song entirely within the framework of a story. The topic is thus personalized from the perspective of the two main protagonists who meet for a rendezvous. Typical for storytelling is also the depiction of a conflict. The two have different opinions, with which the viewers may identify. Niklas Kolorz and Sina express their emotions intensively through facial expressions and gestures (e.g., frowning, sad face, waving their hands). The choice of words and their emphasis also convey the emotions in the story, for example, through the use of strong language: "I have never eaten this shit again since I heard about this statistic" (TC: 01:46; the emphasis here is underlined, as in the following examples). The repetition at min. 03:44 ("If nobody acts, climate change will win in this country") emphasizes the importance of this statement. Especially the final sentence in the last verse "I hope you know what that means" (TC: 04:02) in connection with the following pictures (pigs in the slaughterhouse, globe, harvesting machine in the field) and sounds (scene 50) indicate the desired emotionalization, whereby rapid picture changes and the black screen at the end take on a dramatizing function. Screeching pigs and the sound of knife blades are reminiscent of the sounds of a slaughterhouse—an indication that animals must die in agony for human consumption. The scientific arguments mentioned are all concrete examples and some of them are additionally illustrated. Niklas Kolorz, for example, holds out a plate of sliced apples to Sina and says: "I can serve you the apple and you can eat it down to the last morsel. But a chick with feathers and fibers and a brain, you eat only packaged and breaded" (TC: 02:10-02:17). Due to the format, the audience is only involved at the end, after the song is over and Niklas Kolorz

calls on the audience in the outro to look at the description for more information, discuss in the comments, and subscribe to the channel.

Video_ts is not telling a story with fictional protagonists. Instead, Sissi Kandziora talks in a conversational tone about her personal view on the subject, incorporating her past into the story and describing her experiences. Thus, personalization is also used here, albeit differently than in the first video. Sissi Kandziora does not express her emotions through facial expressions and gestures as much as in *video_nd*. However, this would not fit into her video format, in which she appears more like a calm person. Nevertheless, it becomes obvious that the topic seems important to her. Thus, at the beginning of the video, she says twice that she has dealt with the topic very intensively (TC: 00:09 and 00:52). She explains that she thinks a lot about what she really likes and that she is now also paying attention to the sustainability aspect. Her emotions are particularly evident in her evaluations in the form of so-called verbal quantifiers (in *italic*), which she particularly emphasizes or repeats: "And it is just *insane*," "how *much* we just consume," "I think it is just *insane* how we deal with it," "[...] you keep buying *more* and more and more" (TC: 03:11-04:12). Unlike the other two YouTubers, Sissi Kandziora doesn't use music or sounds. Of the three, she involves the audience the most. Already in the introduction, she asks the audience for comments: "I am [...] always super grateful for your tips and suggestions, your opinions" (TC: 01:38). She always addresses her viewers directly when giving tips, and uses concrete examples, which she partly links to her own experience and which young people could implement in their everyday life, for instance: "The most sustainable way would be to give an existing garment another life, for example by shopping in a second-hand store or getting something from your friend or out of your mom's wardrobe. As in my case: ..." (TC: 05:35).

In *video_dw*, the storytelling unfolds from the reportage-like style. Dillan White takes the viewer with him on his journey and shares his experiences and emotions on-site when visiting the landfill and collecting garbage with the WWF youth. He also uses emotionalizing verbal quantifiers such as "unbelievable," "rad," "mega," or "disgusting" when evaluating the situations on-site. Moreover, similar to Niklas Kolorz, he uses many gestures to express his emotions while describing his experiences, as in scene 23, when he reports what he has seen underwater during his dive. When he says "that's not even that cool" not only his voice seems sad, but also his facial expression. Dillan White emphasizes the beauty of the sea at several points and visualizes this with numerous shots. Right at the beginning, he welcomes the audience "here in this incredible scenery" (TC: 00:19). At the same time, the problem is also visualized—not only by the pictures of the plastic garbage on the beach but also by Dillan White showing his garbage at the end of the video, which he produced during the week. The viewer sees, for example, what a landfill looks like on-site and how much rubbish is on beaches and in the sea. The wording and the images create a communication context that can evoke emotions in the viewers. Dillan White quite rarely involves the audience directly, only once he says: "Maybe it's something for your next beach holiday" (TC: 02:13) about the beach clean-ups. At the end of the video, he

calls on his viewers to do something for the environment at home and gives them some concrete tips on what they could do to be more conscious about what they buy.

Summary of the Video Analysis

Regarding the category of authenticity, it was found that the videos were designed to fit the respective channel concept in terms of language, setting, and argumentation, and only the subject matter differs from the usual videos of the respective channel. Each video thus has an individual character. Sissi Kandziora always uses the same greeting and goodbye in her videos. Her channel is characterized by a positive mood and motivation. Niklas Kolorz has translated his passion for music into his video and Dillan White combines his message with his love of traveling and stages himself and the landscapes as he usually does. So, there is a continuity with respect to the corresponding channels in all videos, the YouTubers remain true to their way of communicating and their values. Not too many scientific arguments are mentioned and named arguments are not simply strung together but are set in relation to the life world of the viewers, e.g., with vivid examples. The YouTubers clearly show their conviction of the topic they present through their argumentation and expressions of personal opinions. All YouTubers nevertheless use an argumentation that also allows other points of view. Gestures and facial expressions underline the arguments and emotions, appropriate to the respective situation and person.

The language and presentation in the videos, which are familiar to young people, also make them easier to understand. The dimensions of comprehensibility (simplicity, structure, brevity, and stimulating features) are considered (to varying degrees) in all three videos. A simple language with few technical terms and a comprehensible structure is used. All videos are shorter than 10 min. Besides, an appealing visual design and the integration of the scientific arguments into the everyday life of young people support comprehensibility. Involving the audience did not play a major role in the videos, but the viewers were addressed directly, at least during the opening of the video and the outlook at the end.

In all three videos forms of storytelling are present. Niklas Kolorz makes the most use of storytelling by staging his video as a date in a restaurant. Sissi Kandziora uses her own story to convey the video's message and emphasizes verbally how important it is to her. Lastly, Dillan White takes the viewers on his personal journey to discover the problem of plastic garbage at Croatia's beaches.

Reaction of Viewers—Comment Analysis

The views can serve as a first indicator for the reception of the videos. The video of *NiksDa* received roughly 40% more views than the average views on his channel. Both other videos received considerably fewer views than the respective average views on their channels (*Typisch Sissi*—60%, *dillan white* -80%).

At the same time all videos received considerably more likes than dislikes on YouTube (see **Table 1**). *NiksDa*'s video has a ratio of about 33 likes to one dislike, while the ratio is for *Typisch Sissi* at about 39 and for *dillan white* about 249).

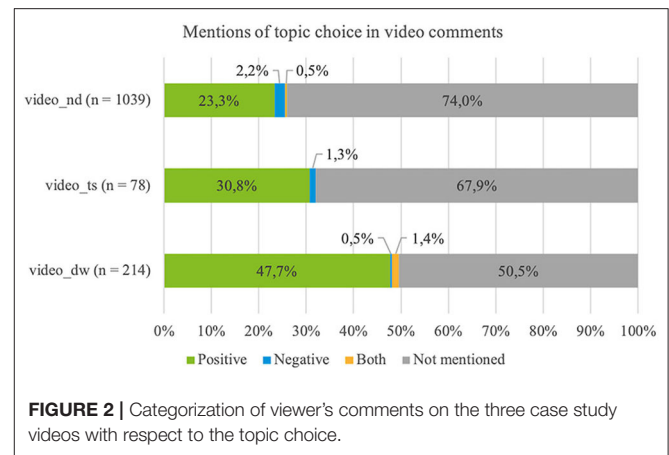


FIGURE 2 | Categorization of viewer's comments on the three case study videos with respect to the topic choice.

In order to get a more in-depth impression of the reception of the three videos by the viewers, a quantitative content analysis of the comments, excluding comments by the Youtubers, was conducted. Overall, the video by *NiksDa* received by far the most comments ($n = 1,039$) followed by *dillan white* ($n = 214$) and *Typisch Sissi* ($n = 78$). Although not equal, this ratio (13:3:1) is roughly following the pattern of overall views for the three videos (8:2:1) and the overall likes (15:5:1—see **Table 1**).

Discussions—indicated by replies to other comments—can be found primarily in the comments to *NiksDa*'s and *Typisch Sissi*'s videos. The former got 270 replies (26% of all comments belonging to the video), whereas the latter got 19 replies—a relatively low absolute number but nevertheless 24.4% of the 78 comments to the video. The video of *dillan white* only received.

Further analysis of the contents is focusing on three aspects: topic choice, comprehensibility, and presentation style. While the analysis is quantitative nevertheless some exemplary comments are quoted to give the reader a better impression of the data.

Topic Choice

The topic choice is mentioned in between 23.3% (*video_nd*) and 47.7% (*video_dw*) of the comments to all three videos. Almost all comments addressing topic choice are positive, appreciating that the YouTubers picked up the topics (see **Figure 2**), exemplified by the following comments:

“Very cool video and I think the message definitely got across. And brave of you to make a video about this topic because it is very controversial. Respect.” (Comment ID Ugz89_wLH7xauE9_YS94AaABAg on *video_nd*)

“Wow mega exciting and important video, super informative, a lot I did not know yet;-) I did not know the day yet either! I think it's great that you draw attention to this topic and make me think about it:-) [...]” (Comment ID UgzOuYi4AD_upuT_1gx4AaABAg on *video_ts*)

“i just think it is so great of you to use the reach you have to address such important issues thank you” (Comment ID Ugy_ijFh-D7yKB-REfV4AaABAg on *video_dw*)

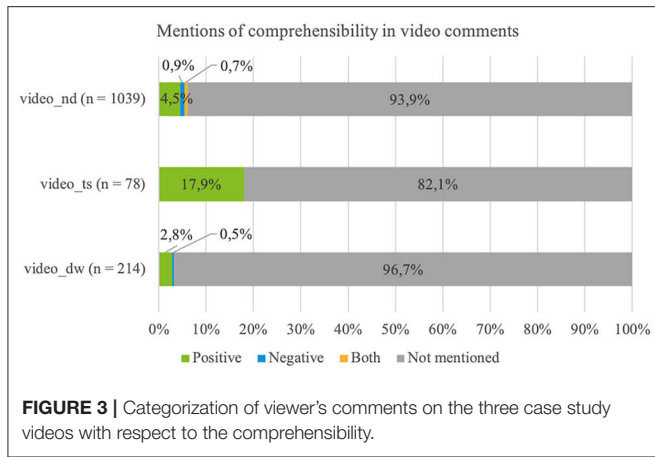


FIGURE 3 | Categorization of viewer’s comments on the three case study videos with respect to the comprehensibility.

Only the video of *NiksDa* also received a relevant small amount (2.2%) of negative comments—23 in total, whereas both other videos only received one negative comment. This might be attributed to the topic itself, with vegetarianism/veganism directly influencing personal preferences and life decisions, and thereby also causing emotional counter-reactions, as the following exemplary comment illustrates:

“then eat salad and do not annoy everyone with the stuff”
(Comment ID UgysNL1OyvHjOsBzwIZ4AaABAg on *video_nd*)

This interpretation is corroborated by several comments, which were not coded as negative with respect to the topic choice according to the scheme, but which display ironic or provocative wording regarding personal food choices [e.g., “And now a big schnitzel or two” (Comment ID UgzY5yFERXumqH3NjRB4AaABAg on *video_nd*)].

In contrast to previous studies (Shapiro and Park, 2015) the comments primarily stayed with the topic focus of the video, which might be explained with primarily followers of the channels commenting and not people who found the video when searching for a specific scientific or societal topic.

Comprehensibility

Comprehensibility is the aspect out of the three aspects analyzed mentioned the least by viewers with only 6% of all comments addressing it. The aspect is most commonly mentioned in the video of Sissi Kandziora, with 18% of the comments there, whereas for the other two videos only 6% (*video_nd*) and 3% (*video_dw*) of the comments mention this aspect.

Also, here, if comments address the issue, they are primarily positive like in the following illustrative quotes from the comments on the three videos:

“Insane how you can put so much information into such a good song much of it I didn’t know about it [...]”
(Comment ID Ugx5VlaQaaaYHO-k5pF4AaABAg on *video_nd*)
“So great that you make so many videos about sustainability & you never get the feeling that it must be very difficult 🌱🍓”
Comment ID UgxGd5qwQp3oBzKCoaxh4AaABAg on *video_ts*)

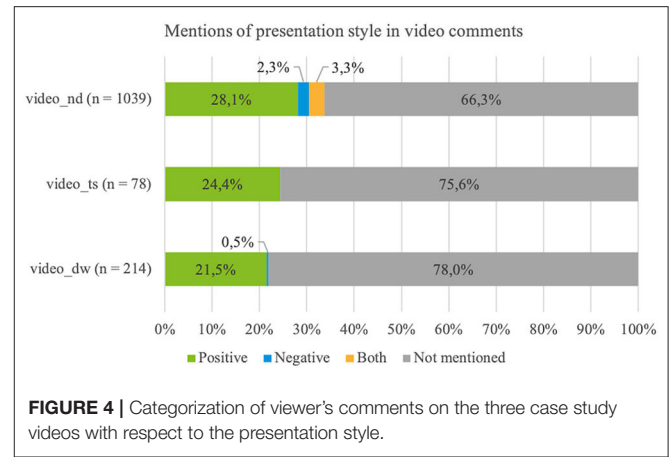


FIGURE 4 | Categorization of viewer’s comments on the three case study videos with respect to the presentation style.

“Great video, great content, explanations etc. [...]”
(Comment ID Ugz6eQRHY_-5RXShERx4AaABAg on *video_dw*)

Only very few comments (0.75%) criticize the comprehensibility of the videos and can be found—with one exception—exclusively in the comments to *NiksDa*’s video. However, since the absolute numbers of negative or negative in combination with positive comments are even lower than for the topic choice, no further conclusions can be drawn from that (see **Figure 3**).

Presentation Style

The presentation style is mentioned in 31% of comments to the three videos, also here primarily positively. The aspect is mainly found in the comments to *video_nd* (34%), followed by *video_ts* (24%) and *video_dw* (22%) predominantly in a positive way:

“Important topic pretty well-presented. Great song and just awesome <3”
(Comment ID Ugx-UHhrXsQ1wn7NQON4AaABAg on *video_nd*)
“Sooo a great video. Both on the information level, but also incredibly aesthetic! Gladly more about the topic <3”
(Comment ID UgwFmbFUNeunazPRorB4AaABAg on *video_ts*)
“[...] Your videos are totally awesome. Top 🍌🍓 you even learn something! It’s good that you can also deal with such topics and integrate them well into your videos. [...]”
(Comment ID UgzcE1WzATDVHvCcsXB4AaABAg on *video_dw*)

As for topic choice, also here the only exception is the video of *NiksDa* receiving 2.3% negative and 3.3% negative as well as positive comments (see **Figure 4**). This could be explained by the fact that the overall concept as a music video is more unique and contains more pronounced style elements and at the same time is prone to judgments by aesthetic preferences of viewers. The direction of the comments classified as negative supports this interpretation—many address music flaws:

“Triple oscillator does not fit in and flow errors. Typical ‘youtuber music” (Comment ID UgyLYSmsMpx_CQ0TFa94AaABAg on *video_nd*)

In summary, the comment analysis supports the impression one gets when looking at the like-to-dislike ration: All three aspects looked at—topic choice, comprehensibility and presentation style were predominantly positively received in the comments when mentioned. This indicates that the deviation from the channels' usual topics did not undermined their authenticity.

Discussions in the comments—measured by the number of replies to other comments and indicating a more thorough examination of the content—could only be found in larger numbers for *NiksDa's* video and with lower absolute numbers for *Typisch Sissi's* video. This might be explained by the greater controversy of *NiksDa's* topic in contrast to the other two videos, as well as, by the request for feedback at the end of both videos, which is missing in *dillan white's* case.

While we did not analyze the content of the discussion beyond the three categories above, the coders gained the impression that the discussion about *NiksDa's* video focused on topical aspects while the ones about *Typisch Sissi's* video were more concerned with the exchange of concrete tips—which would correspond to the respective requests made by the YouTubers at the end of the videos.

CONCLUSION

Summary of Results

In accordance with the results of previous studies (Breuer, 2012, 105 f.), this analysis corroborates the finding that authenticity plays a central role in the presentation of science web videos, especially when established YouTubers are presenting scientific content that is not part of their regular repertoire. The YouTubers of the three analyzed videos of the case study have selected their topics in a cooperative approach with the team and thereby presumably were able to select aspects according to their authentic interest. In two of the videos, the YouTubers also made explicit connections to their personal experiences and critically reflected them (specifically fashion consumption and traveling). Furthermore, each video was presented in an individual and, thus, authentic setting, style and storytelling approach that fits the respective influencer and the corresponding communities. The three YouTubers used specific youth language only to a limited degree and stayed with their usual everyday language. In general, the language and structure of the videos are simple and comprehensible, the included scientific arguments focus on selected aspects and are tied to examples from everyday life.

The comments analysis shows that this approach in general was successful at least to some degree. However, one has to consider that only one out of the three videos reached more viewers than the average viewers per video for the channel. Still, the comments regarding the topic choice and presentation style have primarily been positive with almost no criticisms for all three videos, which suggests that the viewers of the videos are a self-selected sample of the fans of the channels more interested in the respective topic. The comprehensibility of the videos was mentioned relatively rarely in the comments, albeit predominantly positive, which is in line with a low-threshold approach of science communication that does not put information density upfront.

The overall results tie in with the results of an evaluation of the previous project “DU HAST DIE MACHT” [YOU HAVE THE POWER]. There the young people interviewed also praised the authenticity and comprehensibility of the contributions, which was important for all young people, regardless of the type of school they attended (Besand et al., 2013, 84, 65f.). It also became apparent that videos—especially those with individual statements by peers—are more popular than texts, especially among secondary school students (Besand et al., 2013, 61, 74).

However, the desire for a dialogue between scientists, YouTubers and young people, which also was stated as a goal by the project team, could not be realized in the campaign. While the YouTubers were to a limited degree in a dialogue with the young people through the commentaries, direct communication between scientists and young people via YouTube comments did not take place besides isolated instances. This was also expressed as a point of criticism by the project team itself during the interviews (TH). Discussions in the comments could generally only be found for one of the videos.

In addition, it can also be concluded that solitary videos on science and environmental topics within the channels of influencers, as it was the case with the #EarthOvershootDay campaign, are not sufficient to reach the target group lastingly, which also the producers of the campaign have found (NK, SK). For this it might be necessary to address the topic more substantially (Humm and Schrögel, 2020, 10) as other influencers have done on their own accord. One example is Louisa Dellert, who started as a fitness influencer and now regularly addresses politics, sustainability and environmental issues (Herrmann, 2020). While such a “transition” might bear the risk of losing some of the followers who might dislike the changed scope of topics, the marginal rate of negative comments regarding topic choice in our sample somewhat mitigates this assumption. Furthermore, the YouTubers themselves actively consider this issue, as Sissi Kandziora stated in the interview: “I take the viewers with me for many years and many know from the phase when I did a lot of shopping and many also rethink through my channel.”

Limitations of the Case Study

Although the findings of the case study analysis are in line with theoretical expectations and previous empirical works, wider reaching conclusions can only be drawn tentatively. Due to the design of the study with a focus on the material and production level, no information on the actual reception of the videos and the effects on viewers (e.g., learnings, changes in opinion and perspectives and impact on actual behavior) could be gathered besides the limited comment analysis.

The socio-demographics and especially the educational background of the actually reached audience could not be assessed reliably. The interviews with the producers and the analysis of the comments did not lead to any indications that the audience differed from the typical channel audience of the influencers, but there is also no verified information on the exact composition of these typical audiences beyond the assessment by the YouTubers themselves.

Outlook

It would be a worthwhile endeavor for future studies to fill the knowledge gaps listed in the limitations above: a more detailed analysis of the actual audiences as well as a more detailed analysis of reception processes and learning effects (short-term as well as long-term including effects on behavior change).

Looking at the practical implications for science and environmental communicators, our findings encourage cooperation with influencers on social media to reach new audiences beyond the proverbial choir. Although the composition of the reached audience could not be empirically assessed, it is a plausible assumption that non-scientific influencers on YouTube (in contrast to specific science influencers like Mai-Thi Nguyen Kim in Germany) have a different—i.e., less academic—audience compared to the channels of academic institutions. The general guidelines on engaging with underserved audiences identified in an earlier review can also be applied to this context: “Starting with listening (1), reducing the distance (2), relevance for everyday life (3), going where people are (4), cooperation (5), and implementing long-term activities (7)” (Humm and Schrögel, 2020, 10). The missing sixth recommendation would be the “openness paradox” (stating that mandating active participation might build additional barriers), which seems less relevant for existing online communities, such as followers of YouTube channels, with an established discussion culture—another advantage of working with influencers who already built a community. Applied specifically to the online context, these recommendations translate to: start with listening and do not just assume interests and previous knowledge (1), choose accessible channels, language and presentation style (2), relevance for everyday life including societal and political participation (3), choose established platforms [and keep an eye on TikTok (Hayes et al., 2020)] (4), cooperate in an authentic partnership with influencers (5), and establish longer (and mutually beneficial) partnerships with communities and influencers (7).

Nevertheless, working with influencers is no “all-purpose tool” with guaranteed success. This is illustrated by the below average number of views for two of the three videos, which might indicate that they did not resonate too well with the typical audience of the channels despite the many likes and positive

comments on the videos. However, the comments as well as the like ratio were predominantly positive. While the chosen methods do not allow for any conclusions about how intensively the viewers engaged with the video’s topics, the fact that a quarter of the comments for two videos were replies, might indicate such an engagement took part at least partly.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. 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

PS devised the project. LK developed the approach and conducted the study as her Bachelor’s thesis, supervised by PS. PS and CH conducted the comment analysis and provided feedback on the study. LK, PS, and CH wrote the manuscript. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fcomm.2020.601177/full#supplementary-material>

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