TikTok: To Confront Hate Speech?

Priscila Álvarez Cueva

Universitat Pompeu Fabra - Communication Department

Introduction

More than two years ago, I was at home with one of the most beautiful and kindest persons I have in my life. We had been talking about politics and family over tea and, at some point – although I cannot recall exactly why, we ended talking about personal feelings and insecurities. This person started to cry and said to me: "do you know how I feel when I see all those beautiful bodies on my profile feed? I hate myself".

Researchers all around the world keep looking into the effects of social media consume on both identity and identification processes, precisely due to emotions such as the one expressed above (Sheldon, Rauschnabel, & Honeycutt, 2019; Tettegah & Noble, 2015). Indeed, identification is a powerful and necessary resource for every person and, as such, not being represented might be – among other things, a constant suffering and questioning of oneself. Furthermore, some studies have argued how the state of stress and anxiety due to the interaction with social media content is even more complex when it comes to younger generations (see Abi-Jaoude, Naylor, & Pignatiello, 2020). Moreover, we should keep in mind that identity is no longer defined by a single parameter or generalization. Instead, identity is fragmented in many ways, and it requires different processes to understand and embrace the self (Hall & Du Gay, 1996).

Along the necessity of identification processes and to respond to the importance of representation, cultural production seems to be gradually integrating new portrayals in television series (Masanet, Ventura & Ballesté, 2022), movies (Jimenez, 2022) and, lately, even in music (Alvarez-Cueva, Figueras-Maz, & Medina-Bravo, 2021). Even



though these ideas of inclusion may highlight a shift in the previous images that society used to interact with, social media remains as an opening for new and broad content that does not necessarily follow the trend of the cultural industries, does it?

After being crushed by hearing the phrase "I hate myself", the person I have mentioned in the previous paragraphs and I started to search for new "models" and content examples on social media, particularly on TikTok and, to our own surprise, there were many new representations, one after the other: racialized, gendered, coloured, and of course young in a vast majority of cases. These images and videos conform – in my understanding, newish and different options for identification. Indeed, I have myself thought as well that maybe TikTok does have a potential to improve, support and fulfil some of the needs related to constructing the self (e.g., self-identification), at least to some extent.

From the social sciences, particularly when it comes to both communication and advertising, it is always interesting to keep updated on what is happening around new trends and forms of communication. There is probably no longer a point in arguing how the Internet has changed our individual and social life over the past decades – although the pendent argument might be around either how positive or negative this change was (an interesting debate for another space). What is clear is that the vertiginous dynamic on online social media is increasingly captivating many audiences around the globe and, indeed, new trends, forms of communication, and even social activism are taking place, especially when it relates to young people.

Contrary to what some adults and teachers comment about social media and young people activities in relation to it, due to the seminar-module "Journalism and TikTok" at the Communication Department of the Pompeu Fabra University, I have witnessed that not all young people are actively participating on social media at all, particularly on TikTok. In fact, some of these young students may argue that social media in general, and TikTok in particular, are meaningless sources of entertainment where most people spend their time procrastinating and scrolling for unlimited irrelevant content all day long. However, I have also witnessed that being in touch with TikTok's content is almost inevitable and, believe it or not, this content does not only relate exclusively to young people, but to an intergenerational range. In fact, one way or the other, TikTok is close to every one of us and maybe we are not seeing the whole picture of its potential either because we refuse to participate in the apps and trend activities or because we do not have more information regarding how to use it in our own benefit, in the first place. Furthermore, let's take a brief look at how education and communication have evolved in the past decades and how this evolution is anticipating the future consumerism and education due to social media platforms.

From the "Transmedia literacy in the new media ecology" research project, led by the Communication Department of the Pompeu Fabra University, we understand that from the 1980s on, especially since the World Wide Web expansion in the 1990s, mobile devices and social media emergence became a catalyst for social change in our contemporary societies. "The general perception is that the social life of children, pre-teens and teens, revolves around a set of digital technologies and new practices that are often very different from the educational protocols of schools" (Scolari CA, 2018, p.2). If this is the case with the education field, maybe we can anticipate a similar scenario when it comes to cultural production. That is, that even with the changes that have been made so far in TV series and movies, the social practices and understandings (especially among young people) may differ as well.

According to the study, two are the main concepts that one might need to keep in mind when making sense of the relationship between new technologies – such as mobile devices, and behavioural changes and practices among society. The first one is *transmedia literacy*, the second is *transmedia skills*.

Transmedia literacy focuses on what young people are doing with the media, considering them prosumers (producers and consumers, at the same time) able to generate and share media content of different types and levels of complexity. On the other hand, Transmedia skills are a series of competences related to digital interactive media production, sharing and consumption. These skills range from problem-solving processes in videogames to content production and sharing in web platforms and social media – (Scolari CA, 2018, p. 4).

For instance, a study analysed food content creation made by some young influencers and pointed out that one of the key elements to such practice is related to the "like-minded people": "This like-mindedness can refer not only to the general food context but also to specific issues (...) the communication of

'know-how' can be a source of pleasure, especially if individuals can be helped and reply with positive feedback" (Weber, Ludwig, Brodesser, & Grönewald, 2021, p. 6). These kinds of interactions are part of the success and increase interest of social media all over the world. By analysing Instagram, another study discusses how curating activities are central to create a digital persona, content creation and validation from others. This process, according to the authors, may lead to a professionalized use of the platform (Márquez, Lanzeni, & Masanet, 2022).

Moreover, another study analysed the use of streaming platforms such as Twich.tv and pointed out that live streaming may be a remarkable emancipatory and entrepreneurial space for people with disabilities and mental health problems (Johnson, 2019). In relation to both Twich and TikTok, the study conducted by García Rivero, Martínez Estrella, and Bonales Daimiel (2022) argues that these platforms have become sources and tools for both studying and socializing due to the lack of the communication strategies of different social players.

Due to the intrinsic relationship of the "transmedia literacy" and "transmedia skills" concepts, plus the many studies related to the online social media role and activities, I have approached TikTok – since the COVID-19 lockdown took place, in order to explore what kind of content is being created there and what debates are also gaining attention among them.

TikTok: A Case To Resinification?

TikTok is a mobile social app that has reached the classification of "the most downloaded app since 2020" (Forristal, 2022). Through a set of unique characteristics, TikTok has been positioned as one of the most influential apps among youth, although it is still increasing on its audience's penetration, including not only different generations but also traditional media outlets, celebrities and both private and public organizations. "There is a lot to be said about the success of TikTok and where it's going. The social media app is mainly dominant for its relevant trends, unique algorithm and a diverse set of communities for every niche subject matter" (Forristal, 2022).

Indeed, TikTok's characteristics has responded to a changing reality where short videos in vertical format rule the process of communication, nowadays. An article published in 2021, by the University of Zurich, argued that "TikTok has emerged as a hub for creativity and is being used by educators and governments to reach out to the younger demographic" (Zeng, Abidin and Schäfer, 2021). Indeed, this relationship is also taking place in Spain. An article published by *El Profesional de la Información* analysed how PP, PSOE, Ciudadanos, Podemos, and Vox adopted and use TikTok in their political communication strategy campaigns. In this sense, the authors argued that Podemos and Vox generate more engagement and seem to understand and exploit TikTok's specific affordances better than the rest (Cervi & Marín-Lladó, 2021)already widely used before the pandemic, boomed during the

quarantine that locked down large parts of the world, reaching 2 billion downloads and 800 million monthly active users worldwide by the end of 2020. Of these 800 million users, 41% are aged between 16 and 24 years. This social network, widely known for its entertainment videos, is increasingly becoming a place for political discussion and therefore a unique opportunity for political actors to (re. Another recent example of this dynamic took place in the Ecuadorian past elections, where the communication campaign through TikTok became a trend and helped to position outsider candidates among the younger electors. Moreover, there is still a unique logic regarding TikTok's interest indicators. According to Alvino (2021), three are the most important. First, the user's interactions, which include video likes, shared videos, followed accounts, posted comments and number of videos created. Second, the video information with elements such as length, subtitles, sounds, stickers, and hashtags. And third, the own setting of the platform, this means the language preference, location, and type of device of the user.

Furthermore, and as I have mentioned before, social platforms in general, and TikTok in particular, have shifted some norms of the communication process. Particularly, when it comes to denounce and speak up regarding topics such as gender violence, mental health or hate speech, the use and impact of social media became more transcendental than ever. For instance, a recent study published by *BiD: textos universitaris de biblioteconomia i documentació* of the Universitat de Barcelona, identified denunciation, self-defence, prevention, and awareness content of different experiences women had concerning the use of Uber. According to the authors, the self-defence contents shared on social networks (which included TikTok) are configured as tools that serve to deal with harassment situations (Pires *et al.*, 2022).

In particular, TikTok became significant with other trends that took place only in this platform. There was a particular case in 2021, when a missing teenage girl was rescued in the United States after using a hand gesture that signals distress or domestic violence to get the attention of a passing driver. The gesture, reportedly used by the teenager to signal violence or distress, was first introduced by the Canadian Women's Foundation in 2020, through TikTok, and has been adopted by some women around the world who need to discretely ask for help (see image 1).

Teen rescued after showing domestic violence hand signal known on TikTok, police say

Kentucky driver called police after seeing 'female passenger making hand gestures known to represent violence at home'



Image 1: The Guardian news entitled "Teen rescued after showing domestic violence hand signal known on TikTok, police say".

Moreover, according to an analysis of Hanna Midan and TikTok, conducted by Arias Oñate (2021), this young woman started sharing content on TikTok basically to talk about Africa and its culture. However, due to the continuous racist comments on her videos, Hanna shifted her content creation and uses the platform to resist and respond. In this manner, instead of denouncing the situation and talking about it in what one might call the "usual or traditional way", this young woman preferred to launch these gags with irony, which cause the message to reach people quicker. Indeed, using elements such as humour and dance may serve to confront hatred and stereotypes (Tunca & Nwankwo, 2022; also see Matamoros Fernandez, Rodriguez, & Wikstrom 2022).

The "To Do" Examples to Further Develop a Problematization About Tiktok

Until this section, I think it is necessary to warn the reader not to get me wrong. I am not trying to promote TikTok use or to increase its profits in any stance, nor am I taking for granted that all TikTok trends or uses are positive. I, nevertheless, wish to note the context regarding the use of this app because we may see its potential for our own activities as educators, researchers, leaders, and actors in society.

Nowadays, so many different things are overlapping in our societies. On the one hand, to approach hate speech we might keep in mind that racist attitudes seem to be supported by some groups and particularly the right wing around the world – I might address here that the technology itself is not the core problem to this regard, although it has been proved that both the construction of the algorithms and the social dynamics play an important role in the way such apps and platforms work (Gonzales, Hancock, & Pennebaker, 2010; Salganik & Watts, 2009). A recent study published by *Comunicar*, shows that hate speech serves several functions, this means as either defence or reaction to a perceived threat, conveying a sense of power, or instrumentally enhancing one's position in the social group. Therefore, the authors suggested that by knowing the specific motivations for hate speech might help to derive individually tailored intervention strategies (Guiñez-Cabrera & Mansilla-Obando, 2022).

On the other hand, platforms such as YouTube and Tik Tok are being used by *prosumers* to highlight educational discussions around different and relevant topics. The article entitled *Booktokers: Generating and Sharing Book Content on TikTok* (Guiñez-Cabrera & Mansilla-Obando, 2022) tackled a set of categories that are interrelated in the production and consumption of book information through this platform, such as performance and effort expectancy, social influence, hedonic motivation, habit, price value, and the generation of community and networks. Indeed, there is a significant influence of performance expectation on acceptance of social media for academic libraries. Therefore, I should address one main question: might TikTok be a breaking point to face hate speech? Let's resume, for a minute, what I have mentioned regarding the process of content creation and curation. Going beyond the public persona on social media, creators and influencers may play an important role when opening options of representation that shift traditional practices rooted in a racist and misogynist society as ours is. Liking and sharing some of the counternarratives through such a viral app (TikTok) may also have an impact on both the community and at social level, and very likely on well-being as well.

Illustrative Cases - Jeremy Shepherd and Mara Jiménez

To point out the question: might TikTok be a breaking point to face hate speech? I am about to use two (out of many) examples I have been following for the last months in TikTok. These are: "Propaganda gringa falsa que aprendí en la escuela" and "Gente gorda haciendo cosas".



 Seguir

 1265 Siguiendo
 1.8M Seguidores
 32.5M Me gusta

 YOUTUBE: Intervenciones Gringas
 PODCAST: Intervenciones Gringas Podcast

 PIInktr.ee/wokkawokka
 PIInktr.ee/wokkawokka

Jeremy Shepherd



Mara Jiménez

madredecroquetas 📀

Images 2 and 3: Captures from illustrative cases' Tik Tok accounts.

wokkawokkawokka 오

On the one hand, Jeremy Shepherd has over 1.9 million followers in his TikTok account, where he usually disassembles some of his former education, back in the United States (US). One of his most viewed videos is related to the creation of the Wall Street, the New York Stock Exchange, and their relationship with the Potoncillo Market. In this video, Jeremy denounces black slavery as the foundation of the wealth of the most important banks and companies in the United States. By arguing how the propaganda from the United States overlooked the racist theory and history while building its nationalist spirit, Jeremy Shepherd is bringing new ideas and discussions to the table and offers new ways of learning and discussing such issues.

On the other hand, Mara Jiménez has an audience of more than 225 thousand followers. In her videos, she uses humour and irony to ridicule comments related to fatphobia and body shame. In one of her many videos, she imitates a help-line attendance with the most absurd complaints and, while "helping to solve them" she subverts those complaints and reinforces values such as self-esteem and freedom.

Both examples are in line with the professionalization discussed in some studies. This means, that both content creators have a particular topic when it comes to curate their videos. In both cases, too, the practice is particularly relevant since



Image 4: Capture from Jeremy Shepherd @ wokkawokkawokka Tik Tok account.



Image 5: Capture from Mara Jiménez @ madredecroquetas Tik Tok account.

beyond the content, the audience may perceive these representations as authentic due to the creators' positionality (Hou, 2019; Rauchberg, 2022). On the one hand, the case of Jeremy as a United States citizen who has studied in the United States and, on the other hand, Mara Jiménez as a fat woman dealing with such comments and facing discrimination based on her body appearance.

The Potential on TikTok

As other studies have suggested, to create and reflect the "online persona" on social media may be seen as an opportunity for work and marketing. However, when done properly, I mean, when the audience feels identified and reads these personas as authentic, other emotions and practices take place and one my argue that denounces and call-for-actions do happen as well. Therefore, within the examples I have presented above, the positionality of both Jeremy and Mara might be read as authentic. In so doing, these creators not only shift normative and traditional discourses and social norms, but also open new options for identification processes among young audiences.

One might argue how young people use TikTok to continually join world music trends and, in so doing, identity construction processes may also take place – which may be true. But to single brush these practices as the only type available on the app would be a mistake. TikTok, likely or not, goes beyond dancing or lip syncing. Activities such as cooking or working out, or tips for make-up and pets, as well as history, travel, movies, and education tasks are part of the content that has been created on this social app and, maybe, we can take advantage of it. In this essay, I have grasped some out of a vast research field that is still answering questions related to identity, mobile media effects, its uses and so on. Nevertheless, as I have mentioned in my presentation in Yuste Foundation's Campus Yuste, we – as teachers, educators, researchers, politicians, and organizations, have a debt in trying to truly open ways where young generations can actively participate and help create a better society. If anything, the 2022 Campus Yuste proved this to a great extent. I will, therefore, present some ideas to make the reader reflect on this matter one last time.

To Further Promote a Critical Debate

In general terms, though this still requires empirical research in order to be supported, I might suggest that TikTok is continually poorly categorized. To raise critical thinking, I will start with the urge – especially from old generations, to try to simplify the characteristics that define young identities. Usually, due to overconcern, there is a constant underestimation about what young people can or cannot do. It is the constant paternalization to rule what young audiences should learn – followed by the ideas that categorize the "proper information", usually intertwined within high-brown or low-brown production, what is located at the core of *adultcentrism* (Duarte Quapper, 2015; Vásquez, 2013). This means that there is more concern on analysing youth and young people's practices from our own views and values than learning from them freely, without a constant judgement. In fact, this over judgemental attitude is what increases the intergenerational gap and digs deeper in the discomfort of young people towards older generations.

Moreover, it is not only our duty but rather our obligation to promote the intergenerational dialogue that allows, in turn, young people's active participation. With this reflection, I would like to suggest the following tools as the most relevant to generate the changes our system requires:

Education

There is an urge for a real and transversal axe of transmedia literacy and education. Like it or not, the different apps and platforms that our children and youth are using are far away from disappearing nor are they being monitored or regulated. Instead of desperately trying to control what has been proved cannot be controlled, what if we start the change by learning and teaching how to use the technologies instead of always complaining about them? A quick thought: how to understand and train an algorithm? "It is key to take into account behavioural factors and organize the space for human decision-makers at all organizational levels (from data analysts to frontline workers) to make their own professional judgements rather than follow the default of algorithmic decisions" (Peeters, 2020).



Communication

It is compulsory to leave behind the fear of losing our credibility or professionalism because of joining new ways of communication. There should be no shame in listening to Harry Styles, Lizzo, The Backstreet Boys, Daddy Yankee, or Bad Bunny – I will always include music reference in my texts, as there should be no shame in opening a TikTok or a Switch account. There are reasons to do so. If you want to know about them, a real process of communication is required. Keep in mind that identity is built out of many layers and to simplify them might lead to rejection and communication struggles. Moreover, if we need to reach young audiences, we should take a risk and move forward to new apps and platforms where young people will receive our information. If we are working with and for young people, doesn't it make sense to be where they are and to see what they do and consume? Let's integrate young people along the communication plan and strategies. It is crucial to be on the same page.

However, and this is an idea that I cannot stress enough: a bad communication strategy is worse than no communication at all. So, if we are not really engaged in this idea, it is better not to do it. If you decide to join this, do it well: set a plan, involve young people, and get into action.

The historical responsibility

To position yourself and your actions towards society issues. To do so, keep in mind the historical gap of capitalist societies, the Western world, and the north geopolitical understanding of development, particularly when it comes to children and young people. An intersectional and decolonial perspective should be taken into the scenario for debate, reflection, and creation of a better world. I know I might sound utopic at this moment, but these are the ideas of many of the young people I met at Campus Yuste; minds that were excited to speak up and felt noticed and heard. Now it is our turn, do not let that commitment wane.

Acknowledgements

I would like to thank Yuste Foundation for the invitation and the incredible opportunity of feeling inspired by those young minds. A special thanks to Miguel Ángel Martín, Enrique Hernández Diez and Patrick Burke for their kindness and patience.

References

- Abi-Jaoude, Naylor, K. T., & Pignatiello, A. (2020). Smartphones, social media use and youth mental health. *Canadian Medical Association Journal*, 192(6), E136–E141. https://doi. org/10.1503/cmaj.190434
- Álvarez-Cueva, P., Figueras Maz, M., & Medina Bravo, P. (2021). Evolución de la heteronormatividad a partir de una categorización de los estereotipos de género: análisis de los videoclips musicales más populares. *El Profesional de la información*, 2021; 30 (5): e300501.
- Alvino, C. (2021). ¿Cómo funciona el algoritmo de TikTok? Branch Agencia, ¿Cómo funciona el algoritmo de TikTok? Available at: https://branch.com.co/marketing-digital/como-funciona-el-algoritmo-de-tiktok/.
- Arias Oñate, C. (2021). Nuevas narrativas contra la islamofobia en redes sociales. El caso de Hanan Midan en TikTok y Ramia Chaoui en Youtube. Universidad Rey Juan Carlos.
- Cervi, L. and Marín-Lladó, C. (2021). What are political parties doing on TikTok? The Spanish case. *El profesional de la información*, 30(4), p. e300403. doi: 10.3145/epi.2021.jul.03.
- Duarte Quapper, C. (2015). El adultocentrismo como paradigma y sistema de dominio. Análisis de la reproducción de imaginarios en la investigación social chilena sobre lo juvenil. Universitat Autònoma de Barcelona.
- Forristal, L. (2022). TikTok was the top app by worldwide downloads in Q1 2022 | TechCrunch, Media & Entertainment. Available at: https://techcrunch.com/2022/04/26/tiktok-was-thetop-app-by-worldwide-downloads-in-q1-2022/.
- García Rivero, A., Martínez Estrella, E. C.; Bonales Daimiel, G. (2022). TikTok y Twitch: nuevos medios y fórmulas para impactar en la Generación Z. *Icono*, 14, 20(1). https://doiorg.sare.upf.edu/10.7195/ri14.v20i1.1770
- Gonzales, A., Hancock, J. T., & Pennebaker, J. W. (2010). Language Style Matching as a Predictor of Social Dynamics in Small Groups. *Communication Research*, 37(1), 3–19. https://doi.org/10.1177/0093650209351468
- Guiñez-Cabrera, N. and Mansilla-Obando, K. (2022). Booktokers: Generar y compartir contenidos sobre libros a través de TikTok Booktokers: Generating and sharing book content on TikTok. *Comunicar*, 71(XXX). doi: 10.3916/C71-2022-09.

Hall, S., & Du Gay, P. (Eds.). (1996). Questions of cultural identity. SAGE Publications. Sage.

Hou, M. (2019). Social media celebrity and the institutionalization of YouTube. Convergence. The Journal of Research into New Media Technologies, 25(3), 534–553. https://doi. org/10.1177/1354856517750368

- Jimenez, S. (2022). The representation of women in disney animated films. University of Nebraska at Omaha.
- Johnson, Mark. (2019). Inclusion and exclusion in the digital economy: disability and mental health as a live streamer on Twitch.tv. *Information, Communication and Society*, 22(4), 506– 520. https://doi-org.sare.upf.edu/10.1080/1369118X.2018.1476575
- Márquez, I., Lanzeni, D., & Masanet, M.-J. (2022). Teenagers as curators: digitally mediated curation of the self on Instagram. *Journal of Youth Studies*, 1–18. https://doi-org.sare.upf.edu /10.1080/13676261.2022.2053670
- Matamoros Fernandez, A., Rodriguez, A., & Wikstrom, P. (2022). Examining racist audiovisual memetic media on TikTok during COVID-19 as humorous content that harms. Media and Communication.
- Masanet, M.J., Ventura, R., & Ballesté, E. (2022). Beyond the "Trans Fact"? Trans Representation in the Teen Series Euphoria: Complexity, Recognition, and Comfort. *Social Inclusion*, vol. 10, num. 2, p. 143-155.
- Peeters, R. (2020). The agency of algorithms: Understanding human-algorithm interaction in administrative decision-making. *Information Polity*, 25(4), 507-522.
- Pires, F. et al. (2022) Denúncia i autodefensa d'assetjament sexual i violències a Uber: històries d'usuàries a Twitter i Tiktok. BiD: textos universitaris de biblioteconomia i documentació, 48. doi: 10.1344/bid2022.48.10.
- Rauchberg, J. (2022). A different girl, but she's nothing new: Olivia Rodrigo and posting imitation pop on TikTok. *Feminist Media Studies*, 22(5), 1290–1294. https://doi.org/10.1 080/14680777.2022.2093251
- Salganik, M. & Watts, D. J. (2009). Web-Based Experiments for the Study of Collective Social Dynamics in Cultural Markets. *Topics in Cognitive Science*, 1(3), 439–468. https://doi. org/10.1111/j.1756-8765.2009.01030.x
- Scolari C. A. (2018). Transmedia literacy in the new media ecology: white paper = Alfabetismo transmedia en la nueva ecología de los medios. Barcelona: Universitat Pompeu Fabra. Departament de Comunicació, 16 p.
- Sheldon, P., Rauschnabel, P., & Honeycutt, J. M. (2019). The dark side of social media: psychological, managerial, and societal perspectives. Academic Press.
- Tettegah, S., & Noble, S. (Eds.). (2015). Emotions, technology, and design. Academic Press.
- Tunca, D., & Nwankwo, I. (2022). Confronting Racism and Colonialism in Cécile Djunga s and Trevor Noah s Stand-up Comedy. Stand-up Comedy in Africa, 45.
- Vásquez, J. D. (2013). Adultocentrismo y juventud: aproximaciones foucaulteanas. Sophia, Colección de Filosofía de la Educación, (15), 217-234.
- Weber, P., Ludwig, T., Brodesser, S., & Grönewald, L. (2021). "It's a Kind of Art!": Understanding Food Influencers as Influential Content Creators. In *Proceedings of the 2021 CHI Conference* on Human Factors in Computing Systems, pp. 201–214, ACM. https://doi-org.sare.upf. edu/10.1145/3411764.3445607
- Zeng, J., Abidin, C. and Schäfer, M. S. (2021). Research Perspectives on TikTok & Its Legacy Apps Research Perspectives on TikTok and Its Legacy Apps. *International Journal of Communication*, 15(0), pp. 3161–3172. Available at: https://ijoc.org/index.php/ijoc/article/view/14539