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Can Facebook be used to increase scientific literacy? A case study of the Monterey Bay Aquarium Research Institute Facebook page and ocean literacy.

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Can Facebook be used to increase scientific literacy? A case study of the Monterey Bay Aquarium Research Institute Facebook page and ocean literacy.

Abstract

The Internet provides a unique opportunity for scientists to be in direct contact with the public in order to promote citizens' scientific literacy. Recently, Internet users have started to spend most of their online time on social networking sites (SNS). Knowledge of how these SNSs work as an arena for interaction, as well as for the development of scientific literacy, is important to guide scientists' activities online, and to be able to understand how people develop knowledge of science. This was evaluated by scrutinizing the Facebook page of the Monterey Bay Aquarium Research Institute and the consequences for users' ocean literacy. We investigated which practices could increase the number of users reached by a Facebook story. We also found that Facebook pages do not offer the appropriate social context to foster participation since it has only a few of the features of an arena where such practices could develop.

Keywords: online social media, Facebook, ocean literacy, social network site, scientific literacy, science communication.

1. Introduction

Increasingly citizens use or take part in web-based services to interact with their social circles and to be able to understand and influence the world. In parallel scientific institutions are increasing their engagement in such arenas to be able to inform and engage in dialogue with the public. One particularly pressing issue of debate is the environmental threats to the planet. These threats cannot only be approached with on a governmental level, but is dependent on the knowledgeable actions of the public. The ocean, covering greater than 70% of our planet, is a key system playing several crucial roles for human economic, social and environmental sustainability. However, today the ocean is under several severe threats. The accumulation of carbon dioxide in the atmosphere and in the ocean impacts marine ecosystems and their services (IPCC, 2013) while overfishing puts marine biodiversity at risk (FAO, 2012). Moreover, human sewage and agricultural nutrient runoff are responsible for underwater oxygen depletions resulting in the extinction of ecosystems (Kelly et al., 2011). The increasing social and economic pressure from the exploding human population has led to massive alterations of marine habitats threatening humankind by putting at risk all the services and goods we benefit from and on which we dependent (Halpern et al. 2012).

To counteract these threats on the marine environment, citizens should be encouraged

to participate in the public debate related to marine environmental issues. To do so, citizens need to be ocean literate which, as described by Cava, Schoedinger, Strang and Tuddenham (2005) includes (1) having knowledge about the ocean, (2) being able to communicate about the ocean in a meaningful way and (3) being able to make informed and responsible decisions regarding the ocean and its resources. In that respect, ocean literacy is key for citizens to understand the causes and consequences of the environmental issues threatening the marine ecosystems, to make well-informed choices in their everyday lives and to contribute to the public debate in a participatory democracy.

Since accurate knowledge of ocean science, a component of ocean literacy, is mainly held by marine scientists, it is critical to bring lay people together with scientific experts. Recently, the Internet has become a key resource for learning, sharing of knowledge and communicating with others and thus offers multiple channels to foster communication between citizens and scientists around marine topics. Internet users have started to spend most of their online time on social networking sites (SNS) “allowing them to connect with others and post information and daily updates about themselves to a large network of fellow users of their choice” (Seidman 2014, p. 367). While a wide range of SNSs is available, Facebook, launched in 2004, is the market leader with more than a billion active users worldwide (Facebook, 2013). Facebook not only draws the attention of a massive amount of users but also the attention of many social scientists eager to understand this new phenomenon (for review, see Wilson, Gosling, & Graham, 2012). This study aims to shed light on the interaction between scientists and the public through SNSs. Knowledge of how these networks work as an arena for interaction, as well as for the development of scientific literacy, is important to guide scientists’ activities online, and more profoundly to be able to understand how people develop knowledge of science.

1.1. The case study

The current study investigates the use of Facebook by marine experts to communicate with lay people in order to promote ocean literacy among citizens. While most readers might be familiar with Facebook, a short introduction about the Facebook features of interest for this study is provided in order to understand the further results and discussions.

Facebook is used to connect users (Facebook friends) or users and organizations having a Facebook page (users becoming Facebook fans of an organization).

Each user has:

- (1) A timeline where all the stories a user posts are displayed (in the form of text, video, images, and links) he posted on Facebook,
- (2) A news feed where stories posted by his friends or by organizations he is fan of are displayed.

An organization on Facebook has a timeline (called the organization page) with all the stories it posted, but no news feed (since the organization does not have Facebook friends, only fans). A Facebook user can take several actions apart from posting a story. He can comment on a story posted by his friends or by one of the organizations he follows. The user can show his appreciation for something posted (a story or a comment) by clicking the “like” button and can share a story posted by another user or organization. While sharing a story, the user creates a copy, adds his own description and posts it as his own story (still acknowledging the primary author).

A user’s news feed will not display all the stories posted by all his friends and organizations. Facebook actively filters the stories that will be displayed through an algorithm (Falls, 2012). While Facebook has modified this algorithm over time, three main components are involved in determining if a story posted by a given user (Jon) will be displayed on the news feed of one of his Facebook friends (Jane):

- The *affinity* between Jon and Jane could be understood as their relationship on Facebook. The more Jon and Jane interact with each other on Facebook, the higher their affinity. The higher the affinity, the more likely Jon’s story will be displayed on Jane’s news feed.
- The *weight* of Jon’s story. The weight of a story increases when users act on it (by commenting, liking or sharing it). The higher the weight of Jon’s story, the more likely it will be displayed on Jane’s news feed.
- The *time decay* refers to how long ago a story has been posted by Jon when Jane visits her news feed. The newer the story, the more likely it will be displayed on the news feed.

The news feed does not only display some of the stories posted by a user’s friends or organizations. The ticker, a small area of the news feed, displays the actions that his

friends take in relation to other users that are not his friends or in relation to organizations of which he is not a fan of. This is important for the number of people an organization can reach with its stories. For example, if Jon sees on his news feed a story from an organization he is a fan of and comments on it, and if Jane is on Facebook at the same time, she will see in her ticker that Jon just commented on this story from an organization she is not a fan of and she will be able to see the story anyway. In this case, Jon is part of the organic reach of the story (reach of fans) while Jane is part of the viral reach of the story (reach of non fans).

In this study we investigate the Facebook page¹ of the Monterey Bay Aquarium Research Institute (MBARI)², a private marine research institute that specializes in innovation of technology for the purpose of study the ocean. MBARI's Facebook page (MFP) was created in February 2011. As of June 27th 2012, MBARI staff decided to test a new Facebook posting strategy by modifying three elements. First, prior to the implementation of the new strategy, most of the stories included a link while with the new strategy most of the stories included a photo. Second, the number of words in MFP stories significantly increased from less than 50 before June 27th 2012 to about a hundred words per story afterwards. Third, the stories posted under the new strategy included several elements aiming to trigger fan engagement (a description related to a picture, MFP administrator invited fans to ask questions, and links for further reading).

2. Theoretical framework

The theoretical framework adopted in this study is based on the sociocultural perspective on learning and knowing. This perspective originates from Vygotsky who argued that culture is a part of each individual's nature, and thus the mechanisms of individual developmental change are rooted in society and culture (Vygotsky, 1978). Therefore, when framed from a sociocultural perspective, learning cannot be studied as an isolated process happening in someone's mind, but is rather seen as participation in a range of social activities (Lave and Wenger, 1991; Sfard, 1998; Säljö, 2000; Vygotsky, 1978; Wenger, 1998). From this point of view, learning is based on dialogue, both internal and social. Wertsch and Smolka argued that understanding occurs in the places where two or more voices come into contact (in

¹ <https://www.facebook.com/MBARInews>

² <http://www.mbari.org>

Koschmann, 1999). This social dialogue implies that participation is a condition for learning. Moore (1989) identifies three types of interaction: learner-learner, learner-teacher and learner-content. In that respect, interaction and dialogue are at the center of human learning (Mello, 2012). In terms of collaboration and participation, the Internet offers new venues to gather people across the world (or across the street) around common learning practices.

Another key aspect in learning is the interest supporting the motivation to learn (Lin, Hong & Huang, 2012). Hidi and Renninger (2006) define interest as “the psychological state of engaging or the predisposition to reengage with particular classes of objects, events, or ideas over time.” (p. 112). However, from a sociocultural view of learning, interests are generally understood as people’s engagement, situational and context dependent. This way of viewing the concept of interest is shared by several authors (e.g., Hidi, 1990; Krapp, 2000; Schraw & Lehman, 2001) that describe interest as an interaction between a person (individual interest) and a specific context (situational interest). The potential derived from the person while the content and the environment will contribute to its development. This implies that interest is content specific rather than a predisposition that is applied across several activities (Krapp, 2000). The situational interest is triggered in a given moment by the environment, and may last (or not) over time (Hidi & Baird, 1988). The individual interest is one’s predisposition to reengage with a specific content over time which also has been shown to influence level of learning (Renninger, Ewen & Lasher, 2002) along with attention, recall and recognition (Renninger & Wozniak, 1985). Many scholars who have studied learning in relation to interest and motivation have grounded their research from a cognitive perspective. In this study however, the concept of interest is to be understood in line with the situational engagement that is shown in the empirical material. In that respect our research takes two entry points to scrutinize the learning process related to marine topics happening on Facebook: participation and interest.

3. Methods

By combining quantitative and qualitative methods, we aim to reveal some of the practices adopted in order to create conditions to interact with the public with the purpose of supporting the development of ocean literacy. In this study, qualitative methods such as discourse analysis and semi-structured interviews are used to

investigate what learning opportunities do the activities in the SNSs provide for users to develop ocean literacy. The qualitative method provides data allowing observing the bigger picture rather than dissecting the phenomenon into several variables (Ary, Jacobs & Razavieh, 2002). The quantitative method focuses on questions based on effect of variables that can be quantified, and is used here to investigate what posting strategies help reach as many people as possible. These methods seem complementary since only the combination of the understanding of “how” “why” and “how much” will give us a complete enough picture to answer the research questions. For example, the opportunities and challenges of using Facebook can be discussed in terms of number of interaction on the page but also in terms of quality of the interactions. In that respect, as argued by Silverman (2010) quantitative and qualitative methods should be seen “as complementary parts of the systematic, empirical search of knowledge” (Ibid., p.8).

3.1. Posting strategy

Since MBARI implemented a new posting strategy in order to increase its potential to reach people, it was decided to compare the stories’ parameters (see below) potentially influencing the reach before the new strategy (Period 1: May 27th 2012 – June 26th 2012) and the period during which the new strategy was implemented (Period 2: June 27th 2012- August 27th 2012). The data either were automatically provided by Facebook or were collected manually. The data used for the analysis were:

- Total number of fans: numbers of people following MFP per day.
- Daily organic reach: number of fans that have seen a MFP story per day.
- Percentage of organic reach: percentage of the MFP’s fans reached per day. This was sometimes used instead of number of fans reached daily in order to avoid the effect of the increase of fans over time.
- Daily viral reach: daily number of non-MFP fans who have seen something about MFP through their friends’ actions on MFP (e.g., like, share, comment).
- Daily users’ action: number of interactions with MFP (e.g., like, click on link or on picture, share, play video) per day.
- Percentage of organic reach per story: percentage of fans who were reached by a particular story during 28 days after posting.

- Number of words: how many words are included in each story posted.

3.2. Learning opportunities

Facebook works as an arena for interaction between the users, the content posted and the marine scientists. Through discourse analysis and interviews, we investigate the learning opportunities offered by these interactions.

3.2.1. Discourse analysis

Discourse analysis is a method to investigate the construction of individual and social norms, as well as on the negotiation of social interaction through spoken or written language (Starks & Trinidad, 2007). Through discourse analysis, we observe how fans participate, develop understanding and interest for marine science thanks to MFP.

Facebook automatically, saved and logged all the written interaction related to the MFP stories. We focused on the text-based discourse produced between June 2012 and November 2012 on MFP.

3.2.2. Semi-structured interviews

We conducted semi-structured interviews with MFP fans in order to get a richer understand of the behaviors observed through discourse analysis. We sent a private Facebook message to all MFP active fans (liking, sharing or posting at least once on MFP during the period June – November 2012), whose privacy settings allowed us to get in touch with them. A total of 108 fans were contacted. Eight MFP active fans accepted to be interviewed. Six interviews were conducted on Facebook chat and two were conducted via questionnaire in a Word document. In total, three women and five men were interviewed. Four interviewees were from the USA while the others came from Spain, Germany, Belgium or Sweden.

4. Findings

4.1. Posting strategy

In order to support the development of ocean literacy, MFP stories must first and foremost reach the public. Increasing the number of people reached was the goal of

the implementation of the new posting strategy. The following data serve to understand what practice is efficient in relation to this goal.

4.1.1. Numbers of fans

The number of fans increased over time (Fig. 1). Between May 27th and July 20th, the number of fans increased linearly (2.84 new fans daily; $p < 0.001$). Between July 20th and July 24th, 76 new fans joined MFP (14 per day), as a result of a Facebook event linked to MBARI's Open House. Between July 24th and August 27th, the number of fans increased linearly by 3.09 new fans daily ($p < 0.001$). Apart from the short and steep increase of fans due to the Open House, the new strategy did not significantly increase the rate of new fans joining per day.



Figure 1. Total number of fans over time.

4.1.2. MFP's posting efficiency

To evaluate the efficiency of a page, three different parameters were used; (1) the daily organic reach of the page, (2) the daily viral reach of the page, (3) the daily number of users' actions on MFP (like, share, comment, click on the links or on the photos). Rather than investigating the evolution of each parameter independently, the relationship between the three parameters was investigated. The daily organic reach and the viral reach are related through significant exponential relationships when stories are posted ($p < 0.001$) (Fig. 2).

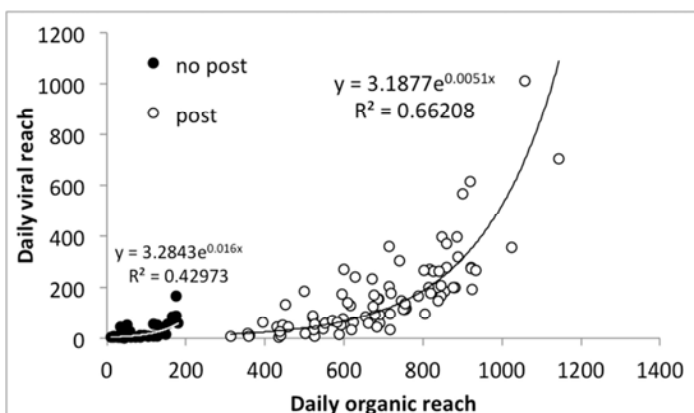


Figure 2. Exponential relationships between the daily organic and viral reaches.

The same exponential relationship is observed between the daily organic reach and the number of actions when stories are posted (Fig. 3).

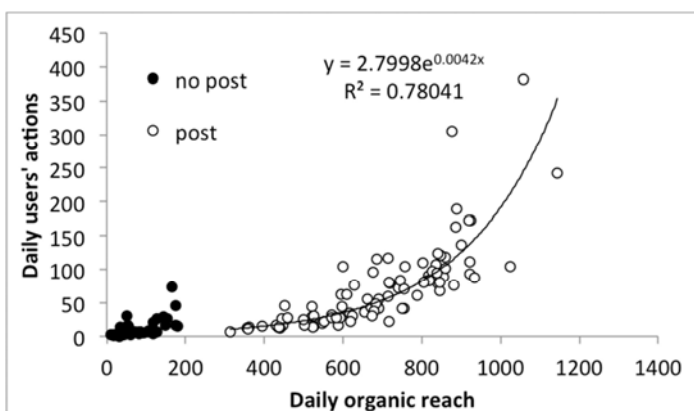


Figure 3. Exponential relationships between the daily organic reach and the daily number of users' actions.

The daily viral reach and the daily number of users' actions both increase exponentially with the daily organic reach, therefore, we investigated the impact of the new strategy on the daily organic reach only. Since the number of fans increased daily, the percentage of fans reached will be used to measure the organic reach instead of the number of fans reached.

Over time, the percentage of daily organic reach was highly variable. This variability can be explained by a combination of several factors. The percentage of daily organic reach was significantly higher ($34.53 \pm 0.82\%$) when a story was posted compared to days without a story ($4.02 \pm 0.42\%$; ANOVA, $p < 0.001$; Fig. 4).

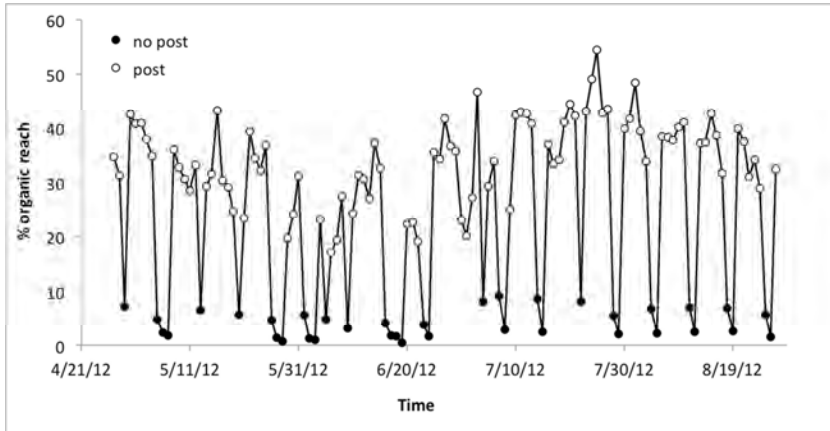


Figure 4. Percentage of daily organic reach through time.

The type of media posted in a story had a significant impact on the organic reach of this story (Fig. 5). “Text + picture” or “text + video” stories had a significantly higher percentage of organic reach than “text only” and “text + link” stories (ANOVA, $p < 0.01$).

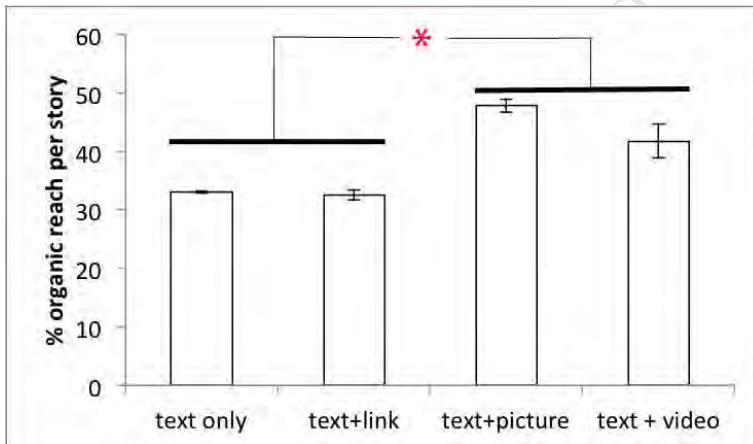


Figure 5. Percentage of organic reach per story for the different type of media.

The percentage of organic reach when a story was posted was also significantly higher (ANOVA, $p < 0.001$) during period 2 ($37.85 \pm 1.02\%$) compared to period 1 ($30.96 \pm 1.06\%$). This difference is mainly due to the fact that images and videos were more frequently posted during period 2 while during period 1, links were the more frequent media used.

A significant relationship ($p < 0.001$) was observed between the number of words composing a story and the percentage of organic reach (Fig. 6). In most cases, long texts were associated with photos (period 2) while short text was associated with links (period 1), therefore it is difficult to argue that the length of the story has a direct impact on the organic reach.

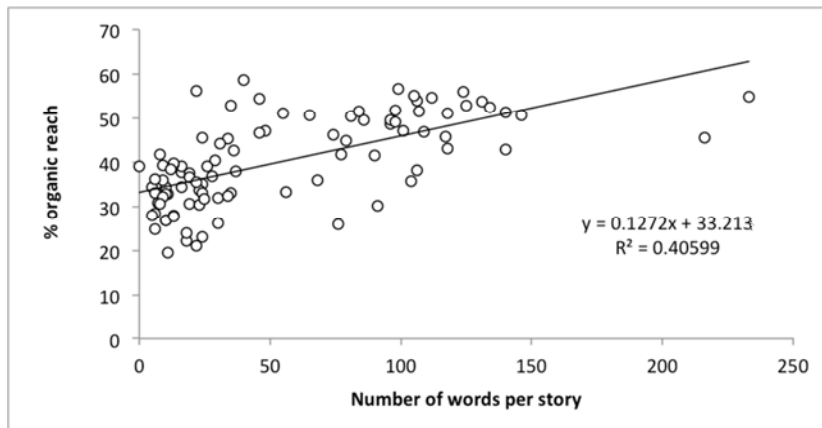


Figure 6. Relationship between the length of the stories and the percentage of organic reach.

Using data from the first half of the experimental period and based on the analyses described above, a predictive model of the daily organic reach was built using the following rules (Fig. 7):

- The percentage of fans reached on a given day corresponds to 1.98% of the total numbers of fans if there has not been any story posted for two days or more.
- If a story is posted with only text or a link (story type 1) 28.55% of the fans are reached. If a story is posted with a photo or a video (story type 2), 35.30% of the fans are reached.
- The organic reach on a given day (day x) increases if a story is posted the day before (day $x-1$). The increase in reach corresponds to 18.26% of the fans reached on day $x-1$.

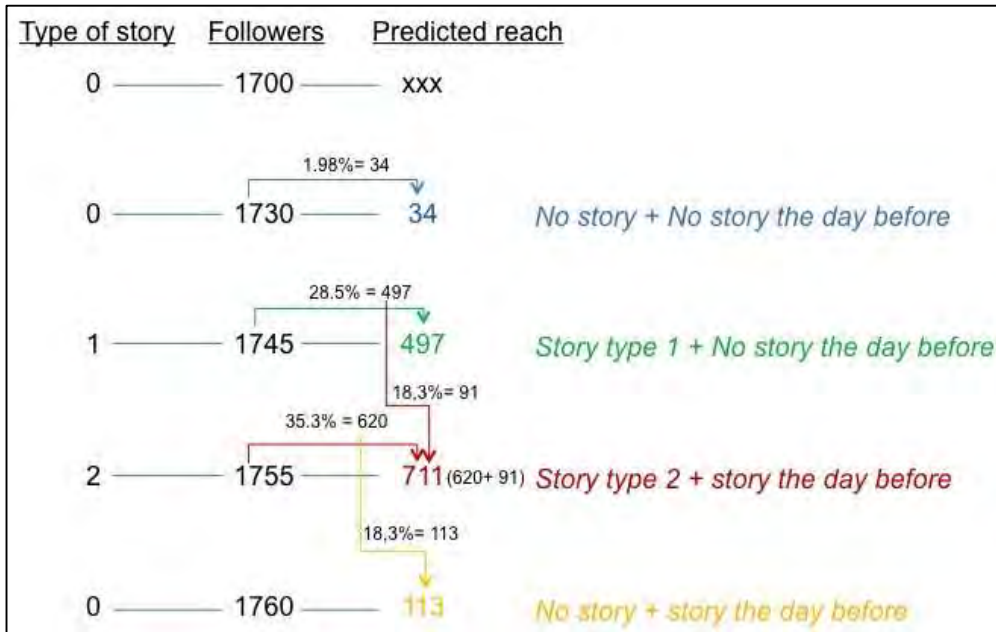


Figure 7. Illustration of the three rules used to build the predictive model. Type of Story: 0- no story posted, 1- text only or text and link, 2- text with video or photo.

Figure 8 compares the predicted and observed daily organic reach. This predictive model explains 89% of the observed variability (linear regressions between observed and predicted organic reach) over the whole experimental period.

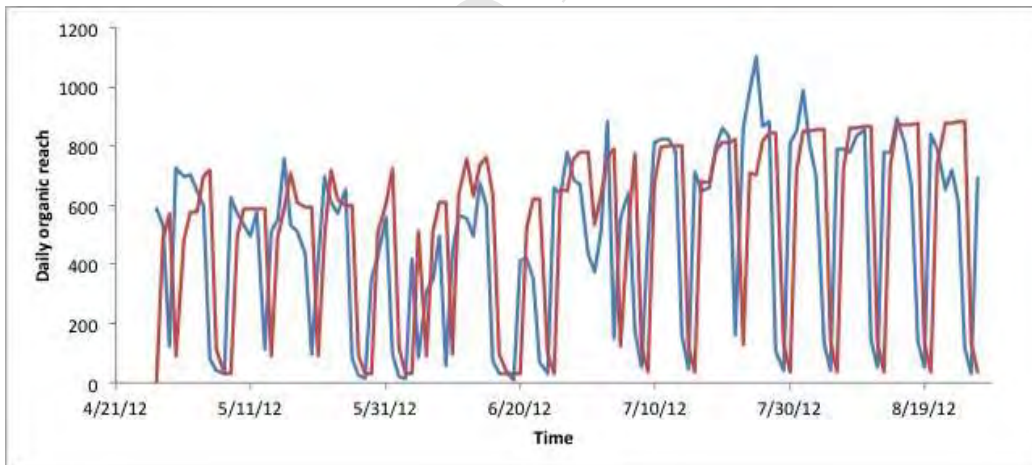


Figure 8. Predicted (red) and observed (blue) daily organic reach of MFP.

This predictive model was used to evaluate different posting strategies. The posting frequency is critical: the higher the number of days with a story in a week, the higher the average organic reach will be (Fig. 9).

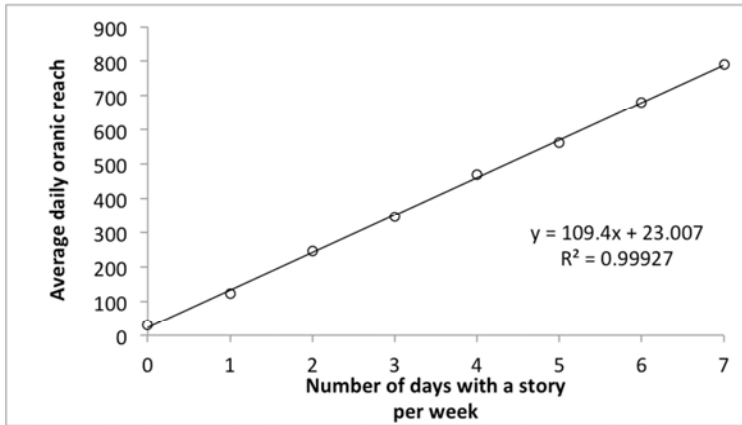


Figure 9. Relationship between the average daily organic reach over the period tested (May 27th - August 27th) and the number of day with a story posted per week.

If stories are posted five days a week, the days of posting only have a minor impact on the average daily organic reach (Figures 10 and 11). The average organic reach corresponds to 563 fans when a story is posted Monday through Friday (scenario 1) while the average organic reach is 559 fans when the 5 stories are posted randomly on 5 days during the week (scenario 2).

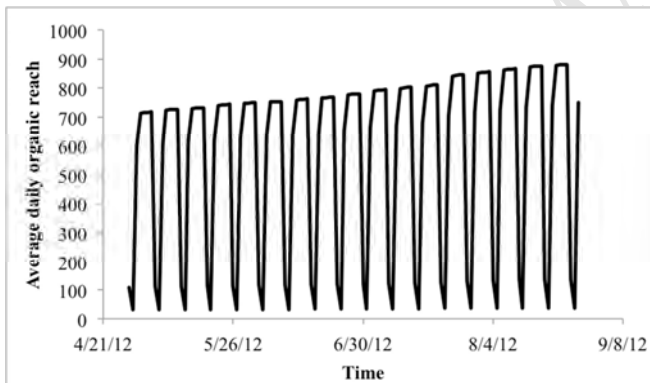


Figure 10. Scenario 1: predicted daily organic reach when one story is posted per weekday.

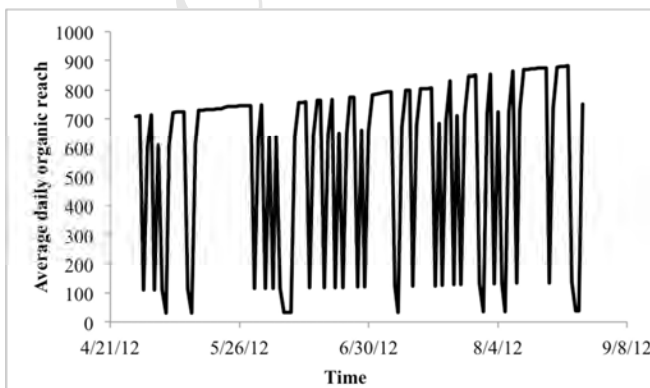


Figure 11. Scenario 2: predicted daily organic reach when five stories are posted randomly during the week.

4.2. Learning opportunities while in contact with the marine-related material

Now that we have a better understanding of how to reach as broadly as possible, we need to scrutinize the learning opportunities created when a user is in contact with MFP stories. To do this, the authors inspired themselves with the types of interactions identified by Moore (learner-learner, learner-teacher and learner-content) (1989) and adapted it to the Facebook environment. This section will be divided in four sub-sections where we will scrutinize the different opportunities for learning triggered by interest and social participation. The first learning opportunity is created when the user is in contact with (i) the story itself, and then is prolonged when the user has the opportunity to interact based on the this story with (ii) the administrator, with (iii) the other fans or with (iv) his own friends.

4.2.1. User in contact with MFP stories

The following excerpts from the interviews illustrate how MFP stories can be seen as situational interest providing support for further engagement with the content.

Interviewee 8: I generally scan the headlines and if it's something I find interesting I will read further.

In this case interviewee 8 describes how he goes from “scanning the headlines” to “reading further”, a more engaged behavior, due to the story serving as situational interest.

Interviewee 5: If I find the story a “jaw-dropper”, I'll definitely hit the share button, put in some of my personal comments and observations and send it on its way to the post.

Interviewee 5 explains how a “jaw-dropper” story (the situational interest) will be the reason he will go from reading this story to a more engaged behavior where he will share it along with his own observation or comments.

The MFP users also express their amazement and interest triggered by the MFP stories (Fig. 12)



Figure 12. Fans' comments expressing interest and amazement.

Some users also clearly expressed how the MFP content teaches them something about the marine environment. One can see that learning opportunities spread over a wide range of marine-related topics such as water properties, marine biodiversity or marine engineering. The users themselves call this encounter with the MFP stories a learning experience as expressed in “I’m enjoying learning about these fascinating creatures” and “this makes learning fun” (fig. 13).



Figure 13. Fans' comments illustrating how they learn when in contact with MFP's stories.

Apart from providing opportunities to learn about something MFP users were not aware of, MFP stories can also represent the opportunity to get to ask a marine-related question the users might have had for a long time but lacked the opportunity to address with the appropriate experts (Fig. 14)

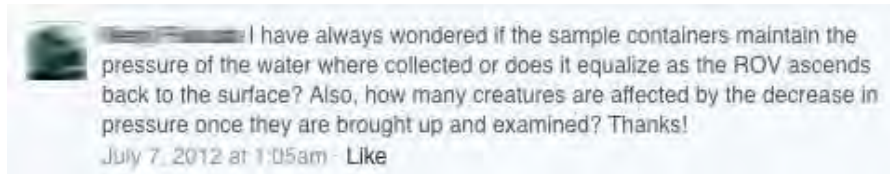


Figure 14. Fan asking a question he had “always wondered”.

4.2.2. Interaction between MFP fans and MFP administrator

Most interactions between MFP fans and administrator take place in the comment section of the MFP’s stories³. The comment section offers the opportunity for fans to interact with the MFP administrator keen on replying to any scientific question. While the comment section could be the space for discussion between fans and administrator, the interactions remains very short with a question asked by fans and the answer provided by MFP’s administrator (Fig. 15).

³ Fans are also able to get in touch with the administrator via the private message function. The subject is often a request for information about studies or internships. The administrator makes sure to reply and to provide the requested follow-up.



Figure 15. Fan-administrator interaction in the comment section of an MFP story taking the form of the question-answer.

This type of interaction was highlighted during one of the interviews:

Interviewee 1: The general dynamics of comments are of the type question-answer with a dominant interaction from the MBARI page administrator as the "teacher".

4.2.3. Interaction between MFP fans

The comment section of a story is an arena offering the opportunity to support learning through discussion. But discussions between fans are rare on MFP as illustrated in figure 16 where fans were invited to participate in a quiz to identify an animal. When a fan suggests that the mysterious animal might be a nudibranch, one fan seems to agree with the suggestion while another one seems to disagree, the three protagonists do not engage in any form of discussion to support their opinions.

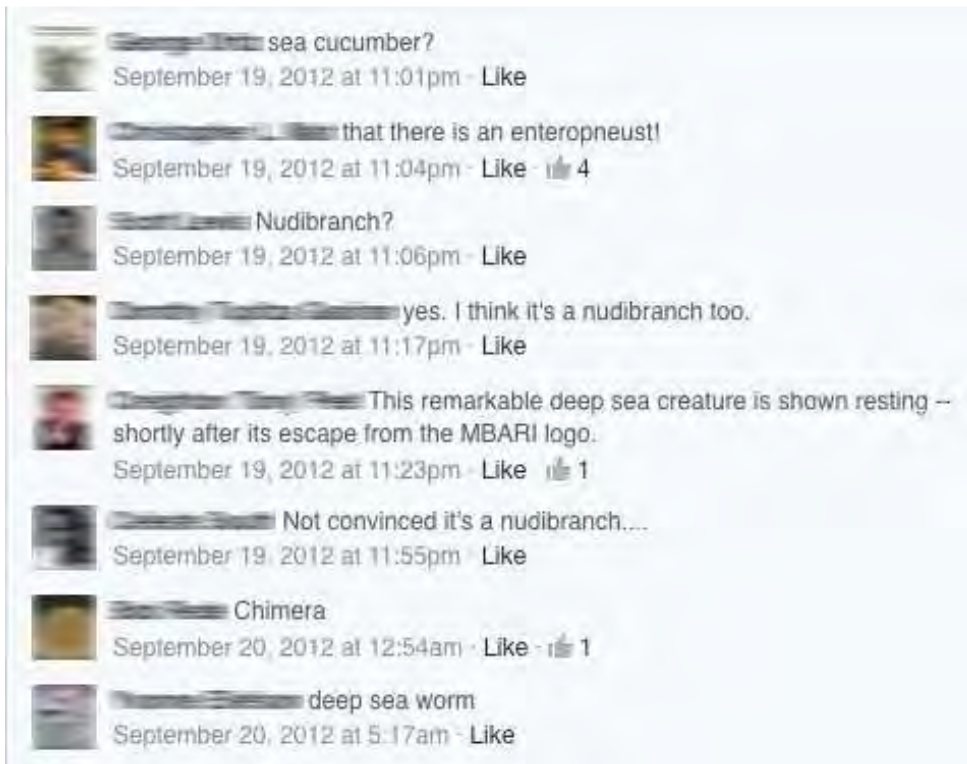


Figure 16. Comments from fans trying to identify a deep-sea.

This lack of discussion between MFP fans was also mentioned during several interviews. When asked why she thought discussions were rare on MFP, an interviewee replied:

Interviewee 1: maybe because of shyness associated with kind of 'saying something wrong' and being corrected.

Interviewee 6 explained that he didn't engage in discussion with other fans because he was "afraid they might laugh at me".

Along with the lack of inclination to discuss due to a certain shyness or fear to be judged, is the absence of interest for other fans' comments as expressed in several interviews:

Interviewee 1: I think people focus more on the content of the post than on the comments other people do.

Again this lack of interest in other fans' comments arose when an interviewee was asked if he paid much attention to other fans' comments:

Interviewee 5: Not really. I'll give them a quick scan but I don't have the time, the energy, nor the inclination to respond/reply to each and every one of them.

Interviewee 3 also stated that he was paying attention to other fans comment “not very often”.

An interviewee also highlighted the same weak interest in fans comment when asked if she read to other fans’ comments:

Interviewee 8: I do not often read other comments.

Yet interviewee 4 described how his comments were directly relevant to the story posted by MFP’s administrator rather than replies to other fans’ comments. He justified his behavior by the fact that the content of the comments from other fans was often limited to words like “great”, “hurra”, “cool” which he thought was not interesting.

There are also some MFP fans interested in other fans’ comments. Interviewee 6 explained that he was reading others “to see if anyone is thinking the same or similar to me and also other’s perceptions.”

This last comment came from the same interviewee who stated being afraid that others would laugh at him. This shows that being interested in other fans’ comments, does not necessarily mean that the fan will engage in discussion. Therefore, fans can consider other fans’ comments as interesting resources without being willing to interact with them.

But the role that MFP administrators themselves could play in fostering fans discussion was also mentioned during the interview.

Interviewee 4: You need to do participation stuffs. To get interaction, you need to make people participate.

Interviewee 8 provided a similar explanation to why fans do not interact more on MFP:

My guess is that the information posted on MBARI’s page isn’t often presented in a way that would facilitate discussions. It is almost always a presentation of something as fact; there are no questions being asked or no requests for feedback.

4.2.4. Interaction between an MFP fan and his/her own Facebook friends

This kind of interaction happens when a MFP fan shares a MFP story that can thus be displayed on his friends’ news feed. The shared story will then be visible for the fan’s friends, regardless if they were or not MFP fans themselves. The fan’s friends

viewing this story can then like it, comment on it or even share it with their own friends.

Since privacy settings allow users to hide their stories from non-friends, most of the shared stories were invisible to the authors of this study. Fortunately, some shared stories were accessible and scrutinized. These shared stories seem to trigger a more fertile social context for discussion than on MFP. In figures 17 and 18 we see fans and their friends discussing around the shared stories in a way that was not observed on MFP between fans. Figure 12 also shows that the shared stories are an important source of amazement and interest for the MFP fans' friends.



Figure 17. Comments from an MFP fan sharing MFP's picture of a cephalopod and her friends (translation from Swedish: "finns dessa på riktigt?"; Is it for real?, "ja absolut, på riktigt!"; yes, absolutely, for real!).



Figure 18. Comments from an MFP fan and her friends after she shares an MFP's picture of a deep-sea fish.

In figure 18, the question raised by friend 1 makes the MFP fan sharing this story accountable for answering it in the absence of possible intervention from MFP administrator. So the MFP fan engages in this discussion by looking for the answer on Wikipedia and explains how she found out that both fish existed (learning opportunity for her and for the rest of her friends). This figure also shows how shared stories offer opportunities for fans and their friends to link the content to their own experience by telling their own stories (as done by friend 2 and friend 4).

Figure 19 contains different comments from shared stories and illustrates how these stories serve as situational interest even for non-MFP fans giving them the opportunity to engage with the content (as the users who will use the shared story in his teaching practice).



Figure 19. Comments from an MFP fan's friends after he shared an MFP story.

During the interviews, interactions between MFP fans and their own friends were mentioned. The reactions triggered by these shared stories seem to vary greatly. A first interviewee described his expectation and the outcome when sharing MFP stories.

Interviewee 5: I really don't have any expectation when it comes to my friends reacting to my shares about MBARI, or anything else I post/share, for that matter. Sometimes I do see a couple of LIKES but seldom a reply or comment in return.

When asked what type of reaction he got, he replied as follow.

Interviewee 6: just "ooooh nice, what is that?" yes that's about as far as it goes.

Another interviewee encounters more reaction and raise her friends interest and curiosity when sharing MFP's stories:

Interviewee 7: I have a few friends that react to it and like the info. Some of them comment on the post and share their thoughts, some wants to know more, and some of them have started to "like or follow" some of the pages I share posts from.

An interviewee expressed this idea of nurturing her existing contacts by sharing MFP stories with them while not engaging in discussion with like-minded fans on MFP.

Interviewee 2: I love to share my passion for the ocean and tell people what is going on. For that reason, I probably use the share button more often than other people. I can't remember that I ever comment on MBARI Facebook page.

5. Discussion

This study aim to shed light on the interaction between scientists and the public through SNSs. As a first step, we were interested in understanding what increases the reach. Through the comparison between the different posting strategies we highlighted several parameters influencing the reach. The media used seems to impact the number of people reached by the story. As a matter of fact, a video or an image gets a better reach than than text or text with a link. We also observed a correlation between the amount of words composing a story and the reach. We showed that the frequency of posting is important to enhance the reach while for a given frequency the

days of posting does not have any impact. We also found out that the regular increase in MFP fans was not impacted by the change of strategy.

Since Facebook has been the focus of many research studies (for review, see Wilson et al., 2012), we were eager to compare our findings with other studies addressing posting strategies on Facebook. Interestingly, while the Internet is full of websites providing advice (in line with our findings) to increase Facebook pages' reach (e.g. Frasco, 2013; Haydon, 2013; Politi, 2012; Zarrella, 2012), we could not find any peer-reviewed research study investigating posting strategies on Facebook.

The second step of this study was to investigate how people make use of the marine-related content that reaches them. Facebook offers several features for social interaction on an organization page. But as suggested by our data, Facebook users do not equally use all of these features (fig.20).

First, on MFP, the interaction between the MFP staff and the MFP fans seems to present a good context for question – answer sequence offering a very unique opportunity for citizens to ask their scientific questions directly to the expert. But this participation does not go beyond this Q-A structure. The communication between MFP administrator and fans stay short and with only few back and forth comments. This opportunity to discuss marine questions is also missed between the fans who show little interest in engaging in discussion with other fans. The only space where further discussions were observed is outside of the MFP itself when fans share stories with their own friends placing them in a more fertile ground for participation and thus learning. In the context of shared stories, it seems that users' development of ocean literacy could benefit from the discussion related to the marine stories shared.

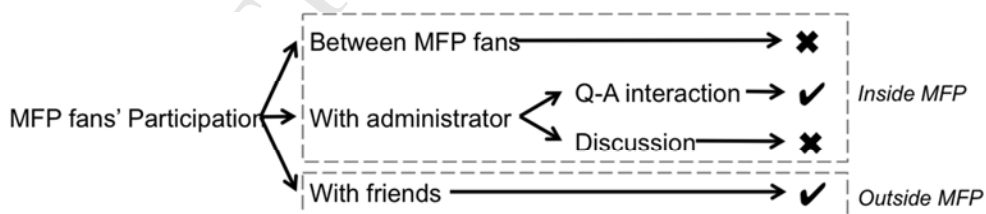


Figure 20. Overview of the different sorts of participation with MFP content.

From a sociocultural perspective on learning it could not be taken for granted that users will participate because Facebook is a media-rich environment offering several venues for interaction. In 1994, Wagner warned about this risk in formal education:

The growing “folk” acceptance of a causal relationship between system interactivity and instructional interaction has placed an unrealistic expectation on interaction technologies to ensure that instructional interaction do occur (Ibid., p. 8).

As expressed by Kreijns, Kirschner and Jochems (2003), in order to trigger social interaction “availability of communication media is necessary, but not sufficient.” (Ibid., p. 341). This point is also raised concerning adult education by Lin, Hou, Wang and Change (2013) arguing that “incorporating Facebook into a teaching activity does not automatically lead to collaborative learning (p. 119). This echoes the opinion of Littleton and Howe (2009) stating that placing children around a table does not mean that they will start to collaborate and work together.

Recent studies on motivation to use Facebook provide some potential explanations concerning the lack of interaction observed on MFP. Researchers have highlighted that Facebook users are mainly looking for maintaining offline pre-existing relationships (Alhabash, Park, Kononova, Chiang, & Wise, 2012; Ellison, Steinfield & Lampe, 2007; Lampe, Ellison & Steinfield, 2006) rather than for meeting strangers or even for communicating with like-minded users (Alhabash et al., 2012; Subrahmanyam, Reich, Waechter, & Espinoza, 2008).

The fact that Facebook users are not mainly looking to get in touch with strangers might explain why the participation is low between fans that don’t know each other on MFP. Moreover, while an MFP fan might feel accountable to reply to one of his friends’ comments on a story he shares, this accountability vanishes on MFP where the MFP administrator is seen as the legitimate entity responsible for answering the questions.

An additional important conditions for participation in such a space is the trust as worded by Rourke (2000):

If students are to offer their tentative ideas to their peers, if they are to critique the ideas of their peers, and if they are to interpret others’ critiques as valuable rather than personal affronts, certain conditions must exist. Students need to trust each other (Ibid., p.2).

Wenger (1998) also argued that people with a strong attachment to a group are more likely to participate but such attachment was not observed on MFP. Moreover, MFP is an open group with more than 2300 fans at the time of the study. In this situation, creating an atmosphere of trust does not seem an easy task and would go beyond the time MBARI is willing to invest in social media communication.

The challenges for participation on Facebook pages described so far seem to indicate that fans do not follow pages to engage in social practices with like-minded strangers. This study focuses only on Facebook and therefore misses interactions generated by MFP but taking place outside of Facebook such in the case of the MFP fan's friend who mentioned his intention to share the story with his students (fig. 5). We have no way to observe the impact this shared story will have on this class of students. Moreover, we focus only on the discourse while we set aside the role of the "like" as a form of involvement or participation on MFP.

The ocean is a fascinating environment triggering amazement and wonder among human beings. The data presented here indicate that the marine-related stories on MFP trigger interest that encourages fans to explore further (by reading more, following links, commenting on content, sharing) and helps them to take in new information. These ocean-related stories serving as situational interest also hold the potential to facilitate the development of personal interest for marine science. Ocean literacy could benefit from the interest many people have for the marine environment since "interest tends to promote exploration with the target activity for its own sake" (Thoman, Sansone & Pasupathi, 2006, p. 338). Dewey (1913) wrote a plea for the importance of interest in the school system: "On behalf of interest it is claimed that it is the sole guarantee of attention; if we can secure interest in a given set of facts or ideas, we may be perfectly sure that the pupil will direct his energies toward mastering" (p. 1). This plea echoes the challenge of paving our way into a more ocean literate society by exploiting citizens' interest in the ocean and its resources. In that respect, marine research institutes in general, possess resources (in the form of images or videos) with an important potential to foster and enhance the personal interest for ocean science by the general public. In that respect, these institutes should be present and active in social media and share their resources in order to contribute to the increased motivation to learn about the ocean and thus contribute to a more ocean literate population.

This study scrutinizes the use of Facebook by a marine institutes from different perspectives. While each perspective gives us a different (but complementary) views

on the phenomenon at stake, there is one beneficial element that keeps emerging regardless of the angle: The shared stories.

While scrutinizing participation as ground for learning, stories shared offer a more supportive ground for discussion than the same story posted on the organization page. A shared story constitutes a trustworthy environment inhabited by people knowing each other in real life and being more accountable to each other than on Facebook pages inhabited by strangers. In that respect, discussion was more frequently observed on a shared story (visible on the user's wall and on some of his friends' news feed) than on the same story posted on the Facebook page of an organization gathering like-minded people.

While looking at the impact of interest on the learning process, the shared stories offer an opportunity for marine-related content to support situational interest among a much wider portions of Facebook users than the limited (and potentially already having a personal interest) group made out of the Facebook page fans. In that respect, the shared stories offer an opportunity for the marine institutes to reach a person they have not encountered otherwise and to potentially support the development of their personal interest in the field of marine science.

Based on the logic of the Facebook algorithm, a story has more chance to be displayed on the fans news feed if its weight is higher. The fact that a story has been shared will increase its weight and thus increase its chance to be displayed on more fans' news feed. In sum, the shared stories seem to be a key resource when employing Facebook to support users' development of ocean literacy. Thus Facebook page administrators would benefit from encouraging their fans to share marine-related stories.

As indicated in our discussion we have not in this study been able to follow the development of threads of communication, which reaches outside of this particular Facebook page, as well as across different platforms of online communication. Further research attempting to extend our knowledge in online communication with regards to public understanding of science using social media could benefit from following such threads, exploring the expansion of communication.

This study explored motivation and interest as manifested in situational engagement. To expand our knowledge of motivation we also would like to encourage focusing on

motivation for participation, and in particular non-participation in relation to public engagement. Here aspects of intrinsic motivation as well as other cognitive theories of motivation have potential to explain more about participation.

6. Conclusion

This study shed light on the practice of marine researchers communicating with the public on Facebook. We also point to how the activities of the marine researchers affect the activities online and the opportunities for developing ocean literacy. As demonstrated above, the presence of research institutes on Facebook seems to raise users interest and to give them the opportunity to learn through direct contact with ocean content. Nevertheless, an organization's Facebook page does not seem to be a suitable space to trigger discussions; therefore, presenting little opportunities for fans to develop their ocean literacy through social participation.

Facebook offers the opportunity to reach a wide range of people with a more or less developed personal interest in science and to develop that interest. The content of the stories posted on Facebook, supporting situational interest, can potentially increase users' individual interest in science, motivating them to learn more about the particular domain.

In this research, we argue that posting practices such as frequent posting of stories with videos or photos help to reach a wider audience and thus can potentially increase the impact of a research institutes presence on Facebook. The shared stories seem to be one of the main keys to increase participation and support the development of domain specific learning on Facebook. This study should be seen as a specific case in a larger problem concerning the relationship between researchers and the public and how scientists can help support citizens' increased scientific and ocean literacies. Nevertheless, the ease of SNS access and their encouragement of social interactions does not ensure success. It is key for scientific organizations eager to benefit from the use of SNSs to be knowledgeable about the particular SNS they intend to use because each SNS has their own rules, features, users and habits.

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Highlights

- We study the use of a Facebook page for developing science literacy
- Posting videos and photos help to reach a wider audience than text and links
- The frequency of posting is important to reach more users
- Facebook pages do not offer appropriate social context for learning
- Shared stories offer a more supportive foundation for participation and learning