

# Engagement Patterns of High and Low Academic Performers on Facebook Anatomy Pages

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**ABSTRACT:** Only a few studies have investigated how students use and respond to social networks in the educational context as opposed to social use. In this study, the engagement of medical students on anatomy Facebook pages was evaluated in view of their academic performance. High performers contributed to most of the engagements. They also had a particular preference for higher levels of engagement. Although the students were deeply involved in the educational element of the pages, they continued to appreciate the inherent social element. The profound engagement of the high performers indicated a consistency between Facebook use in the educational context and better student performance. At the same time, the deeper engagement of high performers refutes the opinion that Facebook use is a distractor. Instead, it supports the notion that Facebook could be a suitable platform to engage students in an educational context.

**KEYWORDS:** medical education, e-learning, social media in education, Facebook, student performance, engagement pattern

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## Introduction

Student engagement in educationally purposeful activities has been identified to have a positive impact on academic performance.<sup>1</sup> Effective educational practices include engagement of students not only in academic challenge but also in collaborative learning and discussion with peers, student-faculty interaction, and campus environment.<sup>2</sup>

With the rapid development in information and communication technologies, various changes have been made in terms of the methods of teaching and learning process. Online social networking sites (SNSs) have attracted a huge following among university students and have become an integral part of their daily lives. Thus, it is not surprising to assume that SNSs have a potential to impact academic performance.<sup>3</sup>

Facebook<sup>®</sup> (Facebook) is currently and has continuously been the leading SNS worldwide.<sup>4,5</sup> Although originally a social network, but with so many students already engaged before they even come to a university, perhaps, it is impossible to avoid its role as an educational tool.<sup>6,7</sup> Many students are adopting it for education by participating in own Facebook groups and following pages with educational themes. Students in higher education courses,<sup>8</sup> including medical students,<sup>9,10</sup> have perceived Facebook incorporation as a classroom supplement to enhance their educational experience. However, there has been a lack of research on Facebook's use as an educational resource.<sup>11</sup>

**The impact of Facebook on academic performance.** Studies have shown contradictory results concerning the use

of Facebook and academic performance. Most of them have investigated the use of Facebook for primarily social reasons. None have been committed to observe student academic performance when engaging with Facebook as a didactic tool administered by the instructor.

In one extreme, some have shown that users who spend more time on Facebook have lower academic performance than nonusers.<sup>12–14</sup> Assuming that Facebook is primarily a platform for social interactions, some have argued that Facebook promotes social engagement but serves as more of a distraction than a learning tool. However, the same authors predicted that an information-sharing service would have more potential for improving academic engagement.<sup>15</sup> Similarly, it was shown that Facebook use is not detrimental to academic outcome if used effectively in an educational context.<sup>16</sup> Furthermore, the same study reported that information-related Facebook activities correlated with higher grades, while using Facebook for socializing was negatively predictive.

It is likely that other factors can cause distraction and affect academic performance. In this respect, it was shown that engaging in Facebook use or texting while trying to complete schoolwork may preclude deeper learning, but the type and purpose of use matters.<sup>17</sup> Furthermore, it was shown that a negative relationship between SNS use and academic performance exists only in students who are more prone to *disruptive* multitasking.<sup>18</sup> Students with relatively high use of study strategies were less likely to be disrupted by task switching to Facebook.<sup>19</sup> Similarly, the time spent on



Facebook was a significant negative predictor of academic performance for younger students compared with older students.<sup>20,21</sup> Students with an initial interest for the university might experience a positive effect of Facebook usage on their studies, as they keep control over their activity and make it a beneficial leisure activity.<sup>22</sup>

On the other hand, it has been reported that Facebook use among university students does not seem to have a negative impact on academic performance.<sup>23,24</sup> Moreover, a positive relationship between students' academic performance and Facebook usage has been illustrated.<sup>25</sup> Some have suggested that academic performance may determine students' Facebook use, rather than the reverse.<sup>26</sup> Others have indicated that social media to be effective in learning contexts requires the involvement of an instructor as a facilitator.<sup>27</sup>

**Facebook terms of engagement.** When Facebook users see a post, they have several options: continue on scrolling to other posts in their timeline, click on a link, image, and video in the post, like, comment, and/or share the post. According to Facebook, engagement is defined as the number of unique people who like, comment, share, or click on a post.<sup>28</sup>

The *Insights* tool provides many metrics for page administrators to track interactions, basically *reach* and *engagement*. The determination of numbers that are important and the interpretation of metrics are dependent on the objectives of the page.<sup>29</sup> The *Insights* tool is exclusive for Facebook pages and not for groups. However, when running a Facebook group, some engagement parameters can still be detected for each post on an individual basis.<sup>30</sup>

For a page with education-enhancement objectives, where the faculty is trying to build a relationship with the audience, engagement metrics rather than reach metrics should be focused on. Reach metrics is less important as it indicates the number of people who saw the content, but seeing could mean scrolling past the content in the audience newsfeed without actually looking at it. Tacitly, it does not truly indicate effectiveness and interactivity.<sup>9</sup>

Engagement metrics indicate interactions beyond just simply views. Engagement is a good indicator on how compelling the post is and how it resonates with the target audience.<sup>31</sup> Generally, the most engaging page posts are short, original, benefit the person viewing the content, and connect with the objectives and identity of the page. Asking questions encourages interaction; similarly, people tend to respond well to videos and photos depicting human interaction.<sup>28</sup>

Another metric to measure interactivity is the *engagement rate*. This is the number of people who were engaged in the post (liked, commented, shared, or clicked) among those who reached it. Generally, >1% engagement rate is good, 0.5–0.99% engagement rate is average, and <0.5% engagement rate is low.<sup>32</sup>

There is an increasing interest in engaging with students through new forms of digital communication media. However, there has been limited research on investigating how

students use and respond to social networks for academic purposes as opposed to social use. In addition, it has not been clearly established what role student engagement through social media could play in the academic context. In order to approach these two concerns, this study examined the extent and level of engagement on educational Facebook pages in view of students' academic performance. Four questions were set to be answered:

1. Who engages more on a Facebook educational page, the high or the low performers?
2. Is there a particular pattern of engagement that represents the high-performing students in contrast to the low-performing students?
3. Which post categories would be most engaging in a page with primarily educational context?
4. In view of the concern about a distraction effect of Facebook, could we suggest a plan to engage the students in an educational content without distraction?

## Materials and Methods

**Curriculum and integrating Facebook.** The use of Facebook was incorporated into anatomy education resources for 92 second-year medical students at the University of Sharjah. The research protocol for this study was approved by the Ethics and Research Committee of the Medical College.

Students studied anatomy in a problem-based learning curriculum that is body-system oriented and characterized by a considerable degree of integration between disciplines. Formal online support to the units included teaching materials that were made available through the Blackboard learning management system (Blackboard Inc.) of the university. The Blackboard-uploaded material included formal announcements, presentations, and objective files necessary for the unit.

Two Facebook pages that were administered by the anatomy content instructors were running simultaneously during the academic year: Human Anatomy Education<sup>33</sup> and Human Anatomy and Embryology.<sup>34</sup> However, the analysis presented in this study was based on the second-semester teaching that covered the gastrointestinal and genitourinary units. The students were verbally informed about the Facebook pages during the orientation session at the beginning of each unit. In addition, a link to the pages constantly appeared in students' handouts that were uploaded on the Blackboard during the unit. However, Facebook participation was optional, and students were not graded on this.

The pages were intended to support but not replace classroom-based teaching with comments, links, questions, pictures, videos, and interactions. Human Anatomy Education page<sup>33</sup> was mainly concerned with anatomy and histology, while the Human Anatomy and Embryology page<sup>34</sup> was more embryology oriented than its sister page. The pages



did not post or duplicate the formal material that was already uploaded on the Blackboard.

**Process and measures.** Apart from quality content, consistently sharing posts is a good strategy to facilitate Facebook engagement.<sup>35</sup> Combined with regular delivery of posts, the pages were administered according to Facebook recommendations to improve engagement of the audience.<sup>28</sup> For that purpose, the posts were regular and diversified but consistent with the themes of the pages, most were in the form of questions, and some addressed the activities of the audience students. In addition, the administrators responded to comments and messages in order to boost the engagement. Since Facebook posts with a visual content generate higher engagement than the average post without a visual content,<sup>36</sup> all posts were accompanied by images in order to maximize engagement. Apart from the explanatory posts, most of the posts were as short and concise as possible because it has been shown that the longer the Facebook post, the faster the response rates drop off.<sup>37</sup>

Post categories included self-assessment questions, subject-related humor, links to online resources (videos, websites, and books), arts and history in relation to anatomical sciences, documentation of anatomy-related activities performed by students or page administrators, and explanatory comments. Table 1 shows a brief description of a representative post within each category and its link. The higher percentage of posting self-assessment questions was based on an earlier survey of in-class students who mostly demanded this post category.<sup>9</sup> Page posts were timed by the administrators to be in synchrony with the anatomy, histology, and embryology objectives instructed during the second semester.

Since Facebook pages are inherently public, the two pages in this study attracted more audience than in-class students. Hence, the Insights tool could not be used to provide feedback on the engagement of in-class students on a separate basis. For that purpose, the engagement of in-class students was manually recorded on a tally table after scrutinizing individual posts that were published during the second semester.

The students were sorted according to their second-semester grades. In the problem-based learning curriculum, the grades represented performance in the body-system unit as a whole and not in separate disciplines. Because this study was concerned with engagement patterns, we did not attempt to specifically track the performance in anatomy content of the examinations. This would have been done if the study was intended to measure the impact of the pages on students' performance in anatomy. Thus, the performance referred to in this study was the overall performance of the student and was not confined to anatomy (histology and embryology inclusive).

Ten highest and ten lowest performing students were included. It was confirmed that all included students were following the Facebook pages and that they had authentic accounts on Facebook that could be confidently linked. The included students gave consent for analysis of their engagement with the Facebook pages.

**Engagement parameters.** The engagement metrics included the number of likes, comments, and shares. However, the engagement parameters used in this study did not include post clicks that constitute part of the total engagements in the Insights tool. Post clicks done specifically by the evaluated students were not amenable to counting in the manual method

**Table 1.** Post categories arranged in order of their number with a brief description of a representative post and its link.

POST CATEGORY	NUMBER OF POSTS (%)	BRIEF DESCRIPTION OF A REPRESENTATIVE POST	LINK
1 Self-assessment questions	221 (47%)	A question on the peritoneal folds of the posterior aspect of the anterior abdominal wall with a reference educational video to check out the correct answer	<a href="https://www.facebook.com/AnatomyEducation/posts/825162164178413:0">https://www.facebook.com/AnatomyEducation/posts/825162164178413:0</a>
2 Anatomy-related humor	79 (17%)	Forgetfulness in anatomy terms	<a href="https://www.facebook.com/AnatomyEducation/posts/817199448308018">https://www.facebook.com/AnatomyEducation/posts/817199448308018</a>
3 Links to online resources (videos, websites, and books)	60 (13%)	The use of augmented reality technology in medicine and surgery	<a href="https://www.facebook.com/AnatomyEducation/posts/822708087757154">https://www.facebook.com/AnatomyEducation/posts/822708087757154</a>
4 Arts and history in relation to anatomical sciences	55 (12%)	Contemporary art exhibition using a human skeleton made of fiberglass	<a href="https://www.facebook.com/anatomyembryology/photos/a.1400803050158265.1073741828.1400799980158572/1439312176307352/?type=3&amp;theater">https://www.facebook.com/anatomyembryology/photos/a.1400803050158265.1073741828.1400799980158572/1439312176307352/?type=3&amp;theater</a>
5 Documentation of in-class anatomy-related activities	33 (7%)	Student's opinion: why do I prefer video lectures in #anatomy education?	<a href="https://www.facebook.com/photo.php?v=791007450927218">https://www.facebook.com/photo.php?v=791007450927218</a>
6 Explanatory comments	22 (4%)	Embryology of congenital inguinal hernia	<a href="https://www.facebook.com/anatomyembryology/photos/a.1400803050158265.1073741828.1400799980158572/1450740225164547/?type=3&amp;theater">https://www.facebook.com/anatomyembryology/photos/a.1400803050158265.1073741828.1400799980158572/1450740225164547/?type=3&amp;theater</a>



used to trace other engagement metrics. However, the manual counting enabled detection of *discussions* as an engagement metric in addition to the generally calculated *likes* and *comments*.

In this study, a discussion was considered to be initiated when the same student commented more than once on a post, replied to another comment, or shared the post on another Facebook account. Once a discussion was recognized for a student, his/her interactions on the post were no longer counted for liking or commenting on the same post in order to avoid counting twice. Thus, discussion could be considered as an indicator of a higher engagement level.

Data were analyzed to provide the percentage of each engagement metric (like, comment, and discuss) within the overall engagements of the student sample. In addition, the percentage of engagement metrics within each of the six post categories was calculated. In all analyses, the contribution among high- and low-performing students was separately determined.

The Insights tool engagement rate, which is the number of people who were engaged in a post among those who reached,<sup>28</sup> could not be determined in the settings of this study. Thus, a modified engagement rate (m-ER) for each post category was manually calculated as an alternative. For that purpose, the total number of calculated engagements was divided by the number of posts within each post category in order to calculate the per post engagement. The m-ER was then calculated by dividing the per post engagement by the number of students included in the study. In doing so, we assumed that all the included students had seen (reached) the post. Facebook engagement metrics mentioned in this study are summarized in Appendix 1.

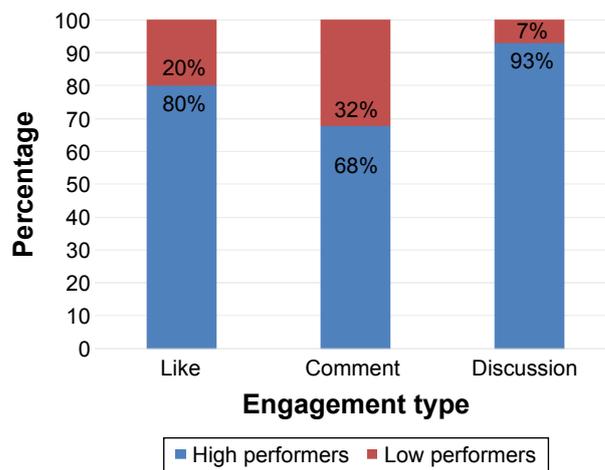
### Results

During the second semester, 470 posts appeared in both pages with an average of 3.6 posts/day. Table 1 shows the number and percentage of each post category.

**Student demographics.** Of the 20 students who were studied, there were 6 (30%) national and 14 (70%) international students. The mean age was 21 years (age range 20–23 years), with a male-to-female ratio of 1:2. This was consistent with the male-to-female ratio of the entire class.

**Extent of engagement.** The total number of likes, comments, and discussions were 932. The high performers contributed to 80.4% ( $n = 749$ ) of the engagements. This highly exceeded the low performers who only made 19.6% ( $n = 183$ ) of the engagements. The mean number of engagements per student in the high performer group was 74.9 [ $\pm 25.83$  standard error (SE)] in comparison to a mean engagement of 18.3 ( $\pm 6.83$  SE) in the low performers. There was a wide variation in the number of engagements within both the high and low performer groups as indicated by the high SE in each.

**Patterns of engagements.** There were 72.6% likes ( $n = 677$ ), 13% comments ( $n = 121$ ), and 14.4% discussions ( $n = 134$ ). In terms of student performance, the percentage of contribution by likes among engagements was almost the



**Figure 1.** Percentage of contribution to each engagement type among high- and low-performing students.

same for the high and low performers (72.3%,  $n = 542$  and 74%,  $n = 135$ , respectively). However, the high performers discussed (16.7%,  $n = 125$ ) more than contributing by a single comment (11.0%,  $n = 82$ ). Within the low performers, the contribution to discussion was the lowest (5%,  $n = 9$ ) among their engagement types after commenting (21%,  $n = 39$ ). In the total engagements ( $n = 932$ ), the high performers had the highest percentage of contribution to each engagement type with a particular predilection to contributing to discussion (Fig. 1).

**Engagement according to post categories.** Both the high and low performers showed almost a similar pattern according to post categories (Table 2). The highest percentage of likes was for humor posts, while the highest percentage of comments and discussions was for the question posts. Apart from the question posts, all other post categories were engaged by likes mainly in both high and low performer groups.

The total m-ER was 19.8%, of which 15.9% was contributed by the high performers and 3.9% by the low performers. The m-ER according to post category is shown in Table 3. The highest student engagement per post was in the posts that documented activity, while the lowest per post engagement was in the link category. This was true for both the high and low performers.

### Discussion

**Who engages more on a Facebook educational page?** The profound engagement of the high performers (80.4%) versus the low performers (19.6%) could be considered as an indicator of a consistency between Facebook engagement in the educational context and student performance. It still remains to be answered whether the high performance of students was a consequence of their Facebook engagement or whether their engagement was concomitant of their performance.

The wide variation in the number of engagements per student within both the high performers (mean 74.9  $\pm$  25.83 SE) and low performers (18.3  $\pm$  6.83 SE) can be explained according

**Table 2.** Type of engagement within post categories among high- and low-performing students.

POST CATEGORY	HIGH PERFORMERS			LOW PERFORMERS		
	LIKE (n)	COMMENT (n)	DISCUSS (n)	LIKE (n)	COMMENT (n)	DISCUSS (n)
Question	21.0% (114)	73.2% (60)	65.6% (82)	14.8% (20)	89.7% (35)	77.8% (7)
Humor	29.4% (159)	17.1% (14)	12.8% (16)	25.9% (35)	5.1% (2)	11.1% (1)
Link	7.6% (41)	1.2% (1)	0.8% (1)	10.4% (14)	0.0% (0)	0.0% (0)
History/Art	12.7% (69)	4.9% (4)	5.6% (7)	12.6% (17)	2.6% (1)	11.1% (1)
Activity	23.1% (125)	3.7% (3)	13.6% (17)	25.2% (34)	2.6% (1)	0.0% (0)
Explanation	6.2% (34)	0.0% (0)	1.6% (2)	11.1% (15)	0.0% (0)	0.0% (0)
<b>Total</b>	100% (542)	100% (82)	100% (125)	100% (135)	100% (39)	100% (9)

to the Visitors and Residents typology for approaching and understanding online behavior. In this model, *Visitors* use the internet in functional terms as a tool, while *Residents* see the Internet as a social space. The Visitors and Residents are the extremes of a continuum that accounts for people behaving in different ways when using technology, depending on their motivation and context.<sup>38</sup> The wide variation in the number of engagements within each of the two sets of students in this study provides evidence that social tools in the educational contexts do not necessarily resonate the same within a group. Even the high-performing students who demonstrated a higher and deeper engagement showed a wide variation in this aspect.

The engagement rate gives a more accurate picture on how audience are reacting with Facebook content.<sup>39</sup> In this study, it was not possible to determine the engagement rate as calculated by the Insights tool because the number of specific students who saw (reached) the post cannot be isolated. An m-ER was calculated as an alternative by assuming that all students under study saw the posts. At the same time, the number of post clicks, which Insights tool considers as an additional engagement metric, could not be calculated for the mere sample of students in the study.

When assuming that all students reached the post and when overlooking post clicks as an engagement parameter, the

calculated m-ER would be played down in comparison to the Insights tool engagement rate. Nevertheless, and according to engagement rate studies on Facebook posts, student engagement in this study (Table 3) is far higher than the average healthy rate of 0.5–0.99%.<sup>32</sup>

Establishing a Facebook closed group dedicated to in-class students would provide engagement parameters exclusive for them. In this case, it is possible to manually count the number of likes and comments as well as who have seen (reached) the post. While instructors might consider this an added credit to monitor the engagement, some students still do have privacy concerns.<sup>40</sup> Students who do not prefer to be detected when seeing a post within a group might refrain from joining.

It should be kept in mind that earlier engagement rate studies were directed toward business-oriented Facebook pages.<sup>41</sup> A recent study on the use of Facebook in medical education by posting questions to a group of students showed that for any given question posted, about 2% of members will respond, regardless of the nature of question.<sup>42</sup> In addition, some have suggested that there are no standard benchmark figures to measure the interactivity on Facebook posts and that is why comparisons need to be set.<sup>43</sup> This was clearly shown in the comparison of engagement rates between high and low performers (Table 3). Although the engagement rate of the

**Table 3.** Modified engagement rate (m-ER) according to post category among high- and low-performing students.

POST CATEGORY	NO. OF ENGAGEMENTS			NO. OF POSTS	m-ER*		
	HIGH PERFORMERS (N=10)	LOW PERFORMERS (N=10)	TOTAL		HIGH PERFORMERS (N=10)	LOW PERFORMERS (N=10)	TOTAL
Question	256	62	318	221	11.6%	2.8%	14.4%
Humor	189	38	227	79	24%	4.8%	28.8%
Link	43	14	57	60	7.2%	2.3%	9.5%
History/Art	80	19	99	55	14.5%	3.5%	18%
Activity	145	35	180	33	43.9%	10.6%	54.5%
Explanation	36	15	51	22	16.4%	6.8%	23.2%
<b>Total</b>	749	183	932	470	15.9%	3.9%	19.8%

**Note:** \*m-ER: modified engagement rate = (number of engagements/number of posts/N) × 100.



low performers (3.9%) was acceptable, the high performers' engagement rate (15.9%) was far more impressive.

The high academic performers who are more engaged on Facebook anatomy pages might well show similar phenomena on other social media platforms for education; this could be further investigated.

**Is there a particular pattern of engagement that represents the high-performing students in contrast to the low-performing students?** It should be noted that liking, commenting, and sharing reflect high levels of engagement. However, a student could have seen the post (reached) but did not actively participate. Yet, a student could have clicked on the post to read details, enlarge a picture, or follow a link. Reach and click can be detected by the Insights tool as numbers but without revealing the identity of the user; thus, they were not considered in this study.

Excluding the post clicks, which can be considered as a preliminary level of engagement, an engagement pyramid can be proposed in view of the revised Bloom's taxonomy of cognitive processes.<sup>44</sup> Post liking, a further step upward in the engagement pyramid, can be likened to *recognizing* in the cognitive process. There is probably variability depending on the context of the post, but as a rule of thumb, those who are more deeply engaged will step up into commenting and beyond into discussing. Commenting could be likened to *understanding* of the instructional message intended by the post. To commit oneself to a discussion on a post could be likened to *critiquing*, a further step in the cognitive process. Consequently, engagements with likes were the highest (72.6%) constituting the base of the pyramid, while higher levels of engagements in the form of comments (13%) and discussions (14.4%) could be considered to constitute the narrower apex. Based on the same engagement model, the high performers who were deeply engaged discussed more than contributing by a single comment, while the low performers discussed the least (Fig. 1).

**Which post categories would be most engaging in a page with primarily educational context?** It was shown that students, although following pages with educational context, still appreciated the inherent social element in Facebook. This was reflected in the highest percentage of engagement in activity and humor posts (Table 3). At the same time, students were deeply engaged in the educational element of the pages by showing the highest percentage of comments and discussions in the question posts, rather than confining themselves to liking (Table 2).

Because the pattern of engagement is also determined by the context of the post, the highest percentage of comments (73.2% high performers and 89.7% low performers) and discussions (65.6% high performers and 77.8% low performers) was for the question posts (Table 2). The latter posts were more demanding than others for commenting and discussing than for mere liking.

Since all post categories used in this study were engaging, it can be suggested that an educational page includes a variety

of posts. Adding some social, historical, and artistic blends to education improves students' collaboration and enthusiasm. Similarly, Sharma et al<sup>45</sup> had shown that resource sharing, enjoyment, collaboration, and social influence were important in Facebook adoption for academic purposes.

**Could a student be engaged in educational content without distraction?** The deeper engagement of the high performers refutes the opinion that Facebook is a distractor that would have a negative influence on academic performance. Similarly, it supports the notion that Facebook could be a suitable platform to engage students in an educational context.

Visitor students who are much more targeted in their use of online tools<sup>38</sup> and those who have distraction concerns may be educated in order to increase their engagement. Instructors and informed students could play an integral role in guiding them to how to only log on to get the information they need from Facebook when they need it.

In order to increase the engagement of the Visitor students and to minimize the distraction issue while using Facebook for education, pages with a similar theme can be included in *interest lists*. This provides direct and timely access to posts of pages without the inherent *distraction* that might arise while going through the entire news feed. Similarly, when a Facebook group is used to address students, members of a group can still focus on certain posts by directly linking to the group from the home view without the necessity of going through the news feed. Correspondingly, page fans as well as group members can choose to be notified whenever a new post is uploaded. They can thus directly review their notifications without the need to browse the entire news feed. Many students might not be aware of these strategies; thus, it would be useful to mention them to students when the instructor intends to administer a Facebook platform in education.

**Limitations of the study.** Two limitations to this study should be addressed. First, post clicks, which are counted by Facebook Insights tool as another engagement metric, could not be detected in this study. Although post clicks are the most basic type of engagement, their omission provided an engagement rate that is less than what would have been counted by the Insights tool. Second, the small sample size of students in this study can only serve as a probe for conducting a more comprehensive analysis. In this case, the possibility of a correlation between engagement and course performance across an entire class of students could be investigated. Despite these limitations, the results provided preliminary information for the purpose of a pilot study.

## Conclusion

The results from this study further address the effectiveness of the emerging use of SNSs in education. High-performing students had more profound engagement in Facebook educational pages than low performers. They were more deeply engaged in discussions than in contributing by a single like or comment.



The deeper engagement of the high performers refutes the impression that Facebook is a distractor. Instead, Facebook is a suitable platform to engage students in an educational context. Although this engagement is not a panacea to improve their academic performance, the consistency was clear.

## Appendix 1: Glossary of Facebook Engagement Metrics

**Reach:** the number of people who saw the post.

**Engagement:** the number of post clicks, likes, comments, and shares.

**Engagement rate:** the percentage of people who reached a post that liked, shared, clicked, or commented on it.

**Discussion:** an act initiated when an evaluated student comments more than once on a post, replies to another student's comment, or shares the post on another Facebook account.

**Modified engagement rate (m-ER):** the percentage of evaluated students engaged with a post. Calculated as an alternative to engagement rate by assuming that all the evaluated students had *reached* the post.

## Author Contributions

Conceived and designed the experiments: AAJ. Analyzed the data: AAJ and MAE. Wrote the first draft of the article: AAJ. Contributed to the writing of the article: MAE. Agreed with the article results and conclusion: AAJ and MAE. Jointly developed the structure and arguments for the article: AAJ and MAE. Made the critical revisions and approved the final version: AAJ. All authors reviewed and approved the final article.

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