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HOW DOES THE USE OF OPEN DIGITAL SPACES IMPACT STUDENTS SUCCESS AND DROPOUT IN A VIRTUAL UNIVERSITY?

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ABSTRACT

Virtual universities have developed considerably over the past decade, particularly on the African continent. They provide a way to deal with the considerable need to educate a large young population, but the lack of physical space can be a drawback that prevents students from succeeding and increasing dropout compared to a more traditional face-to-face university. To limit these issues, some virtual universities have been opening Open Digital Spaces (ODS) to complement the virtual space and offer students a place where to work and solve pedagogical, technical or administrative issues. However, it is unclear how students actually make use of these ODS and which uses can be beneficial or detrimental to their success and limit dropout. In this paper we lead an exploratory study of the results of a large-scale digital survey in a major African Virtual University (N=2392 answers) to identify factors in the use of Open Digital Spaces (ODS) that have an impact on students' success and dropout.

We analyzed the data using multiple Chi-Square tests of independence. Results indicate that students who visit ODSs more during the 2 weeks before an exam or only when it is mandatory are statistically less likely to succeed, contrary to students who come to work in groups or for the internet access who are more likely to succeed. Conversely, students who do not see the value of ODSs for learning and who visit only when mandatory are more likely to dropout, contrary to students who come when they have a pedagogical need or to work in groups who are less likely to dropout. Some factors particularly impact first year university students, highlighting the need to make them understand which use of the ODS are relevant to increase their chances to graduate.

KEYWORDS

Open Digital Space, Learning, Virtual University

1. INTRODUCTION

Many African countries have set up virtual universities: this is the case in Senegal, Ivory Coast, Cameroon, Chad, Tunisia, Egypt, etc. Unlike distance education, which is traditionally reserved for elective training and continuous training with relatively experienced learners, these virtual universities tend to welcome new baccalaureate holders in initial training. These young graduates are neither familiar with the university system, nor with ICT tools. The transition from a face-to-face learning system to an online learning system gives rise to curiosity and a concern for both students and parents. The concern lies in the risk of dropping out of school due to exogenous and endogenous student variables that influence the dropout or attrition rate (Bourdages & Delmotte, 2007). To mitigate the effect of isolation of learners and increase academic and social integration, some virtual universities have made Open Digital Spaces (ODS) available to them (Ouya et al., 2015; Sylla et al., 2020). An ODS is an innovative location made of buildings containing computer equipment and human resources for taking care of students while adapting them to local realities and respecting the best international standards.

The objective of this research is to evaluate the impact of the use of Open Digital Spaces in a virtual university on student success and dropout.

More specifically, we will seek to answer the following research questions:

(RQ1) Which of the different reasons that students visit ODS have an impact on student success or dropout?

(RQ2) Does visiting an ODS other than the ODS one is registered to have an impact on success and dropout?

The rest of this paper is organized as follows: after the state of the art, we present the methodology adopted, then present the analysis and the results obtained.

2. RELATED WORKS

In this part we propose a state of the art of teaching in Senegalese universities by focusing on the strategy adopted by the Minister of Higher Education. Then we will discuss the pedagogical model of the virtual university of Senegal, and finally, we will present the concept of open digital spaces (ODS).

2.1 Higher Education in Senegal

In 2013, the State of Senegal organized a national consultation and a presidential council on the future of higher education in order to ensure an in-depth reform of the system (Dimé, 2018; Fatou et al., n.d.). This resulted in the implementation of the 2013-2017 Priority Reform Program for Higher Education and Research in Senegal (PDESR) (MESRI, 2018). Several recommendations and decisions have resulted from these initiatives, including the creation of the Virtual University of Senegal (UVS) (Daniels, 2020), which responds to several ambitions: putting information and communication technologies at the heart of the development of higher education and research in order to improve access to education and the efficiency of the system, developing distance learning and encouraging teaching and research staff to use ICTs, allowing access to higher education throughout the national territory, and facilitating access to training for all components of society.

2.2 The Pedagogical Model in Virtual Universities

The pedagogical model of the UVS is based on the comodal approach which is inspired by the hybrid model (Diop & Diack, 2018; Tendeng, 2020). The hybrid approach combines face-to-face and distance learning in the transmission of knowledge in order to achieve predefined pedagogical objectives. It promotes collaboration and distance learning, with the learner at the heart of the training device.

Comodality is a teaching formula that provides the most flexibility for the learner. Depending on the schedule, the student is free to attend the course as they would a traditional classroom course. They can also choose to use the synchronous virtual classroom to attend their course without physically traveling and still be able to actively participate in the course. UVS started in 2016, the comodal model adapted to allow the student to adapt gradually with a semester 1 of the first year of the degree (L1) 100% face-to-face and synchronous to arrive at the last semester of the third year (L3) which will be 100% remote (Dia, 2019).

2.3 Open Digital Spaces

The Ministry of Higher Education, Research and Innovation (MESRI), taking into account the socio-cultural aspects and the constraints related to distance learning, provides an original solution to accompany and facilitate access to various resources and services, called Open Digital Space (ODS).

The ODS are designed to offer an efficient technological framework to students, pupils, teachers and researchers, socio-economic groups and other actors. Within the framework of the UVS, the network of ODS will become more and more dense over the years.

UVS students find in their ODS of attachment equipment, resources and computer tools necessary for the proper conduct of educational activities. As a space dedicated for socialization, students find in their ODS support in case of difficulty but also conditions and activities conducive to the strengthening of a sense of belonging.

To facilitate access to digital resources and computer equipment for all, and in particular for students, the UVS has set up ODS throughout the country. These ODS allow students to access equipment, resources and computer tools necessary for the proper conduct of educational activities. They also allow to have physical relays for a good deployment of the UVS, and in this sense, they allow both to have spaces for face-to-face teaching or for collaborative work.

Figures 1, 2 and 3 show views of an existing open digital space (left - from outside, middle - an amphitheater - right - open working spaces).

Figure 1. Front view ODS

Figure 2. Amphitheater ODS

Figure 3. Open working space ODS

3. METHODS

3.1 Data Collected

In order to study the impact of an ODS on learning processes, we sent a survey to all students registered to the virtual university (approximately 45,000 students) both through their institutional email and through some university groups on social networks. The survey was done using the university LimeSurvey platform [https://survey.uvs.sn/index.php?r=survey/index&sid=456915&lang=fr]. This survey was collecting the following categories of information:

- Student demographics: including which ODS the student was attached to, their discipline, their level (1st, 2nd or 3rd year of bachelor), the year they registered to the virtual university which defines their cohort (e.g. every student who started in Sept. 2021 is in cohort 8), and their gender.
- The attended ODS: in particular to know whether they attend an ODS different from the one they are registered to and for what reasons, or whether they attend another open space not related to the university (associated to a city or another university).
- The reasons why they visit an ODS: whether it is for administrative, pedagogical (in particular group work), technical reasons (in particular internet access), or simply to socialize (meet peers), as well as whether they do so only when it is mandatory or if they attend more in the 2 weeks before an exam.
- The time when they visit an ODS: whether they visit regularly and frequently (at least twice a week), whether they visit more to prepare for exams (more visits in the two weeks before an exam), or whether they visit only when it is mandatory (whatever the reason).
- Their perception of ODSs: whether they consider them important for their learning and for their success.

Items used in further analysis are detailed further on in Table 1. Items in the three last categories above are formulated as affirmative statements to which students have to express their level of agreement using a 5-point Likert scale. When frequency was involved, the 5 associated values were “Never”, “Rarely”, “Sometimes”, “Often” and “Always”. At the time the survey was stopped, 2,392 answers had been received, including 1525 complete answers. Students could stop answering before the end of the survey, in which case partial answers were kept when they had reached at least the third section above. This inclusion of partial answers can explain slight differences in the number of answers for each question reported in the results section.

In addition to the survey data, we also used institutional data in order to link the students’ answers to their success and dropout. Success was considered for the year during which the survey was sent (i.e. were they allowed to continue in the next year or did they graduate if they were in their final year). Likewise, a student was considered as having dropped out if they were a no-show in the exams that took place at the end of both semesters of that year.

When merging institutional data with survey data, we did not have access to academic results from all disciplines but we focused on three main ones (in terms of number of replies) over 4 student cohorts (2020-2021 [1st year students], 2019-2020 [2nd year students], 2018-2019 [3rd year students] and 2017-2018 [4th year students, for those who did not fail any semester]).

3.2 Students Sample

From the original sample of all answers, 675 (44.4%) of the students declared to identify their gender as female and 823 (54.1%) declared to identify as male. As aforementioned, due to data access restriction, we consider here 3 different disciplines: 309 students from IDA (Application Development), 200 students from SJ (Legal Sciences) and 192 students from AES (Economic and Social Administration). Over these 701 students, when merging institutional and survey data, we ended up with a subsample of N=402 students' answers used for the following analyses. Among these 402 students, 284 were first year students, 41 were second year students, 48 were third year students and 29 were fourth year students.

3.3 Data Analysis

Data was processed, cleaned and analyzed using Jupyter notebooks in Python and in particular the pandas (1.4.2) library for data processing and clearing, and the pingouin (0.5.2) library which is a wrapper for statistical tests found in SciPy.

Each variable was analyzed in the same way in terms of potential link with success and potential link with dropout. Each variable was dichotomized. For instance, when asked if they were visiting an ODS for technical needs, students who replied "never" or "rarely" were counted as 0 and students who replied "sometimes", "often" or "always" were counted as 1. When a middle value was available, it was excluded for the analysis. For instance, when asked about the value of ODSs for learning, students who agreed or agreed strongly that it was important for their learning were counted as 1, students who disagreed or disagreed strongly as 0, and students who neither agreed nor disagreed were excluded for that item. Some items already had only two possible answers such as the item "do you visit another ODS than the one you're registered to?". After dichotomizing a variable when necessary, we ran for each of them a Chi-Square test of independence where the null hypothesis was that the two variables were independent, and the alternative hypothesis that they were associated. When the number of observations was too low in a cell of the contingency table, we used Fisher's exact test instead. In accordance with (Bender & Lange, 2001), as this is an exploratory study, no adjustments were done for multiple testing and we considered a traditional alpha level of 0.05 for our tests. In addition to the p-value when it was below the threshold of 0.05, we also report here Cramer's V to measure the strength of the association between the two variables and interpret it as suggested by (Akoglu, 2018).

To assess the impact of ODS in the learning process, we define a set of indicators in four big categories listed below.

3.3.1 Location Variables

The relevance of the geographical position of the ODS: This indicator measures the relevance of the location of the ODS in a geographical area in relation to the needs of the learners. This indicator is assessed on the basis of 2 sub-indicators: (1) The attendance rate of the attachment ODS allows us to assess the attendance of the attachment ODS by each learner during their learning. It is worth noting that each student is attached to the ODS closest to his Baccalaureate examination center, but before registration, the student can change their ODS if they provide a justification. The computation of this sub-indicator is based on the percentage of affirmative answers to the question "Do you visit more often an ODS different from the one to which you are attached?" Given that some students may visit other educational spaces different from the ODS to the detriment of the various ODS that surround it, we will not take into account in the computation of the attendance rate of the attached ODS those who only attend other educational spaces. (2) The proximity of the ODS allows us to assess the distance between the attachment ODS and the residence place of the students. This sub-indicator is the rate of students not attending their home ODS for reasons of distance in the question "Why do you attend an ODS different from the one to which you are attached?"

3.3.2 Pedagogical Use Variables

The rate of pedagogical use of ODS is used to determine the pedagogical importance of ODS in the learning process. The calculation of this indicator is based on the statements "I go to the ODS to work in a group", "I go to the ODS for the pleasant pedagogical environment", "I go to the ODS for pedagogical needs (Example: Meeting a tutor or teacher for explanations)" which answers are on a Likert scale of 5 (Never, Rarely, Sometimes, Often, Always) and dichotomized as aforementioned.. In this calculation, a student will only be counted once.

3.3.3 ODS Staff Variables

The quality of the pedagogical staff of the ODS is used to evaluate the capacity of the pedagogical manager of each ODS to help students in their learning process. The value of this indicator is the rate of respondents who confirmed both the statements "I feel that the ODS's pedagogical leader has pedagogical qualities", and "I feel that the ODS's pedagogical leader has a significant impact on my learning". The question "Do you think the ODS has enough pedagogical staff to help students?" is used to determine the sufficiency of pedagogical staff in ODS.

The quality of the technical staff in the ODS assesses the ability of the IT manager in each ODS to solve technical problems with the equipment given to students. To calculate this indicator, only the respondents who answered positively to the question "I go to the ODS for technical needs (Example: computer repair, ...)" are considered. Of these respondents, the rate of those who answered positively to the statement "I think that the technicians at ODS do a good job" and to the question "Do you think that ODS has enough technicians to help the students?

3.3.4 Internet Connectivity Variables

Internet connectivity assesses students' ongoing access to the Internet. This indicator is evaluated in 3 sub-indicators:

Sustainability of monthly Internet Passes: Each student has an Internet connection device (Internet Key or Smartphone Data Mobile). At the beginning of each month, the Virtual University through the Ministry of Higher Education, Research and Innovation provides a predetermined data volume. This sub-indicator is used to determine if the assigned volume pass is sufficient for the month. To achieve this, the question "What is the average duration of the Internet Passes you receive each month?" is used to determine the average duration by weekly range. We consider that a satisfactory average duration is at least 3 weeks. The calculation of the sub-indicator will be the rate of satisfactory average duration.

The quality of the ODSs' Internet connection allows us to evaluate the degree of satisfaction of the ODSs' Internet connection by students. This sub-indicator is the rate of respondents who confirmed the statement "I consider the quality of the internet connection at ODS to be good".

The usability of the ODS Internet connection allows us to evaluate the rate of use of the ODS Internet connection by the needy. A needy person is a student who regularly attends an ODS for the connection (question: "I go to the ODS for the Internet connection") whose average monthly Internet Pass duration is not satisfactory. The calculation of this sub-indicator is the calculation of the rate of needy attending other educational spaces for Internet connection reasons.

The quality of connection of operators by geographical area makes it possible to evaluate the operator providing the best service to students. This sub-indicator is a statistical table of dimension 2 presenting the satisfaction rate by operators and geographical areas.

The importance of ODS for learning is used to determine how students feel about ODS during their learning. This indicator is the cumulative rate of respondents who confirmed the statements "I feel that ODS are important to my learning" and "I feel that the ODS instructional leader has a significant impact on my learning."

4. RESULTS

4.1 Impact on Success

When considering the visit of another ODS than the one students are registered to (N=402, χ^2=2.36, p=.124 > .05) or another open space (N=402, χ^2=0.45, p=.503 > .05), no significant results appeared, indicating that in itself the nature of the ODS visited is not associated with a higher or lower chance of success.

When considering the reasons to visit an ODS, no statistically significant relationship appears between success and visiting for administrative reasons (N=303, χ^2=0.13, p=.722 > .05), visiting for technical reasons (N=303, χ^2=0.32, p=.575 > .05), or visiting for pedagogical reasons (N=303, χ^2=2.49, p=.115 > .05). When reasons breaking down the technical reasons though, visiting in order to use the internet access is statistically significantly weakly associated to success (N=303, χ^2=5.23, p=.022 < .05, V=0.059), where students who declare visiting to use the internet connection are more likely to validate (89.7% vs. 80.8%).

When analyzing reasons that involve socialization, meeting with peers is not associated with success (N=303, χ^2=0.03, p=.863 > .05), however, working in group is weakly associated with success (N=303, χ^2=11.68, p=.000 < .001, V=0.087) where students who declare using ODS to work in group are more likely to validate their year (89.6% vs. 74.5%).

When analyzing the timing of these visits, visiting at least twice a week is not associated with success (N=261, χ^2=0.01, p=.928 > .05), however, visiting more before exams (N=303, χ^2=3.91, p=.048 < .05, V=0.051) and visiting only when it is mandatory (N=287, χ^2=5.38, p=.020 < .05, V=0.060) are both statistically associated with lower success with a weak association (80.1% vs. 88.3% and 79.4% vs. 89.1% respectively).

Finally, when analyzing their perception of ODSs, neither thinking that ODS is helping them to learn (N=358, χ^2=3.22, p=.072 > .05) nor thinking that ODS is helping in their success (N=348, χ^2=0.24, p=.623 > .05) is associated with a higher success.

4.2 Impact on Dropout

When considering the visit of another ODS (N=402, χ^2=0.261, p=.610 > .05) or another open space (N=402, χ^2=3.19, p=.07 > .05), no significant result appeared (p > .05), indicating that the nature of the ODS visited is not associated with a higher or lower chance of dropout.

When considering the reasons to visit an ODS, no statistically significant association exists between dropout and visits for administrative reasons (N=304, χ^2=0.65, p=.422 > .05), or technical reasons (N=304, χ^2=0.70, p=.402 > .05), including visiting for internet access (N=304, χ^2=1.22, p=.269 > .05). However, there is a weak statistically significant relationship between visiting for pedagogical reasons and dropout (N=304, χ^2=4.44, p=.035 < .05, V=0.054), where students who declare visiting for pedagogical reasons are less likely to dropout than those who declare not visiting for that reason (3.9% vs. 9.4%).

When analyzing the reasons that are associated to socialization, meeting with peers is not associated with dropout (N=304, χ^2=0.50, p=.437 > .05), but working in group is weakly associated with lower dropout (N=304, χ^2=9.49, p=.002 < .01, V=0.079) where students who declare using ODS to work in group are less likely to dropout that year (3.5% vs. 12.8%).

When analyzing the timing of these visits, it appears that visiting at least twice a week is not associated with dropout (N=262, χ^2=1.63, p=.202 > .05), nor is visiting more before the exams (N=304 χ^2=1.52, p=.218 > .05), however, visiting only when it is mandatory (N=288, χ^2=6.59, p=.010 < .05, V=0.067) is weakly statistically associated with a higher risk of dropout (9.9% vs. 3.2%).

Finally, there is no statistically significant relationship with the fact of thinking ODSs are useful for success (N=349, Fisher's exact test, p=.180 > .05), but there is a weak significant relationship between thinking ODSs are useful for learning and dropout (N=359, Fisher's exact test, p=.000 < .001, V=0.095), where students who think ODSs are useful for learning are less likely to dropout (5.5% vs 9.6%).

5. DISCUSSION AND CONCLUSION

In summary, it appears the analyses reveal two counterproductive behaviors for success: visiting more before exams and visiting only when it is mandatory. If the latter seems logical because it indicates a lack of involvement, the former may be more surprising. Nonetheless we can hypothesize that among students who come more before exams, many are trying to compensate for a lower involvement in the weeks before, and it might be difficult to catch it up just by coming to an ODS. On the contrary, two uses of ODS seem associated with a higher success: using the internet access and working with peers. We know that an important proportion of students suffer from limited or slow internet access at home, which is why the university provides a mobile data plan but which is sometimes not enough. Students who declare using the ODS for this reason clearly have a strong need, and the ODS play their part in helping them with this aspect. As for working with peers, the benefit of learning as a social activity have long been demonstrated (Wood & O'Malley, 1996), and it seems using the ODS as a gathering place for these activities is a use to promote. Learning collaboratively online is also efficient, but combined with the aforementioned fact that some students do not have a high quality internet access, it seems logical that a physical space is particularly useful for at least some of them. The lack of significant relationship between success and the perception of the usefulness of ODS to learn could appear surprising. Therefore we led a complementary analysis where we separated 1st year students from others. And it appears indeed that for 1st year students there is a statistically significant weak association between success and thinking ODSs are useful for learning (N=243, χ^2=4.43, p=.04 < .05, V=0.088). This allows us to nuance the initial analysis: there are still students who do not see the value of ODSs in years 2 to 4, however, the students who are negatively impacted by undervaluing ODSs are the 1st year students. It is therefore particularly critical to focus communication on the value of ODSs towards this subpopulation.

When considering dropout, analyses revealed one counterproductive behavior that increases the risks of dropout which is visiting only when it is mandatory. Conversely, two behaviors seem associated with a lower dropout: visiting for pedagogical needs and to work with peers. As for success, it shows it is critical for students to understand early on the value of ODSs and visit them for pedagogically sound reasons. Finally, one belief is associated with a higher dropout which is, as for success for first year students, not seeing the usefulness of ODSs for learning.

From the ODSs administrators' perspective, this work suggests which particular uses of ODSs should be promoted, and would indicate that it is particularly critical to focus on first year students. From the students' point of view, being presented with this data analysis could be helpful in convincing them of the maladaptive value of some behaviors (e.g. trying to compensate for a lack of work by coming to the ODSs just before exams). However, it has several limits: this survey was given in the middle of the year, and it could be useful to track the evolution of the perception of ODSs over the year, in particular to track the effect of potential communication campaign towards students. Another limit is the limited sample size when compared to the total number of students in the virtual university, and the more limited size due to lack of access to institutional data for some disciplines. Finally, these results are only for one university in Africa, and it would be particularly valuable to see if these results can generalize to other African Virtual Universities, and if possibly they would differ in other virtual universities across the world.

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