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The Impact of Activity Design in Internet Plagiarism in Higher Education

El impacto del diseño de actividades en el plagio de Internet en educación superior

María Gómez-Espinosa

Lecturer at International University of La Rioja (UNIR) (Spain) (maria.gomez@unir.net)
(<http://orcid.org/0000-0003-1773-4468>)

Dr. Virginia Francisco

Associate Professor at Complutense University of Madrid (Spain) (virginia@fdi.ucm.es)
(<http://orcid.org/0000-0002-4492-5633>)

Dr. Pablo Moreno-Ger

Associate Professor at Complutense University of Madrid (Spain) (pablom@fdi.ucm.es)
(<http://orcid.org/0000-0003-4817-8150>)

Abstract

In this work we aim to gain a better understanding of the nature of plagiarism in Higher Education. We analyse a set of different activities in an online university-level course, aiming to understand which tasks lead more naturally to plagiarism. This analysis concludes that the activities that have a lower rate of plagiarism are activities that encourage involvement, originality and creativity. Subsequently, we reformulate the task that presented the highest rate of plagiarism, taking into account the conclusions of the previous analysis and trying to maintain their relative effort and educational impact. We then compare the newly designed activities with their original counterparts to measure whether there is a significant reduction in plagiarism. The results are clear and show a significant drop in the percentages of plagiarism. In addition, we performed an additional validation to ensure that both groups were, in fact comparable. We found that both groups displayed similar plagiarism attitudes in other exercises that were not reformulated. This study shows that it is possible to reduce the incidence of plagiarism by designing activities in such a way that prompts students to propose their own ideas using information available on the Internet as a vehicle for their solutions rather than as solutions in themselves.

Resumen

El objetivo de este trabajo es comprender mejor la naturaleza de plagio en la Educación Superior. Analizamos una serie de actividades en un curso on-line de nivel universitario, con el objetivo de encontrar qué tareas llevan más naturalmente al plagio. Este análisis concluye que las actividades que tienen una menor tasa de plagio son actividades que fomentan la participación, la originalidad y la creatividad. Posteriormente, reformulamos la tarea que presenta la mayor tasa de plagio, teniendo en cuenta las conclusiones del análisis anterior y tratando de mantener su esfuerzo relativo y el impacto educativo. A continuación, comparamos las actividades del nuevo diseño con las originales para medir si el rediseño conlleva una reducción significativa del plagio. Los resultados son claros y muestran una caída significativa en los porcentajes de plagio. Además, se realizó una validación adicional en la que se analizó la actividad con la segunda tasa de plagio



más alta, encontrando que los grupos eran comparables y mostraban actitudes de plagio similares en otros ejercicios que no habían sido rediseñados. Este estudio muestra que es posible reducir la incidencia de plagio mediante el diseño de actividades de tal manera que los estudiantes se sientan motivados para proponer sus propias ideas utilizando la información disponible en Internet como vehículo para sus soluciones en lugar de como soluciones en sí mismas.

Keywords / Palabras clave

Plagiarism, online education, ciberplagiarism, activity design, student perception, motivation, anti-plagiarism, academic ethics.

Plagio, educación on-line, ciberplagiarismo, diseño de actividades, percepción estudiantil, motivación, anti-plagio, ética académica.

1. Introduction

Academic plagiarism is, unfortunately, a common and widespread issue at all levels. Beyond the most typical cases from young students, it is easy to find high-profile examples of plagiarism reported even in mainstream media. In recent years we have witnessed the resignation of two German ministers accused of plagiarizing in their doctoral theses (Eddy, 2013). And while the problem is not new, the revolution in how we search and process content brought by the Internet has increased the challenge in educational settings. Students are prompted to produce and deliver exercises, essays or solutions to problem statements, and find all this information just a few clicks away (Atkins & Nelson, 2001; DeVoss & Rosatti, 2002; Moore, 2007). In this work we aim to gain a better understanding of the nature of plagiarism, especially in those cases where it is not due to an excessively complicated task.

1.1. Plagiarism in higher education

The Internet has entered all aspects of our daily life, including university classrooms, and a new way of approaching assignments has emerged. Many students seek the fastest possible solution to classroom assignments, regardless of the validity of the sources or respect to the work of others, a phenomenon that is widespread across all educational levels (Sureda, Comas, & Oliver, 2015). In this case, our focus is on Higher Education, where the growth of plagiarism has been an ongoing concern over the past few years (Culwin & Lancaster, 2001; Hart & Friesner, 2004; Clegg & Flint, 2006; Ellery, 2008; Eret & Gokmenoglu, 2010; Bretag, 2013; Heckler & Forde, 2015), and in which teachers are increasingly worried about the frequency and apparent lack of awareness of its moral implications by students (Perry, 2010).

The results of a survey conducted by the companies Six Degrés (2008) and Le Sphinx Développement showed some significant behaviors of students and teachers, identifying the Internet as the main source of documentation (90%) and with 43% of the students reporting that never or seldom cited their sources. These results were consistent with another experiment conducted among 1,025 students (Comas, Sureda & Oliver, 2011) which states that 7 out of 10 university students admitted to copying texts or fragments of texts for the development of their academic activities, presenting them as their own.

Other studies conducted in different environments show widespread use of unethical practices, but introduce nuances. The University of La Rioja (Spain) in 2011-12 conducted an empirical experiment analysing 104 assignments from a university-level degree in Business Management. The students had to submit different assignments during the course, as well as a high-stakes final essay. Among the documents submitted, 13 of them (12.5%) displayed a plagiarism rate higher than 40%, a figure far beyond what could be considered academically reasonable. Remarkably, the higher the stakes in the activity, the lower percentage of plagiarism was found, suggesting an in-



interesting link between the perceived importance of the task and the tendency to plagiarize (Gómez, Vargas, & Salazar, 2012). Regarding the attitude of the students towards plagiarism, a recent study by Newton (2015) pointed out that students considered that «academic misconduct should be modestly penalised», and only developed stricter attitudes after graduation.

Regarding the factors that invite students to plagiarise, even before the Internet was available, Ashworth, Bannister and Thorne (1997) identified four key issues: 1) The lack of awareness by the students concerning whether they are doing plagiarism or not; 2) The low probability of being detected; 3) the pressure on the level of demand and the deadlines established for the works; 4) The actual wording of the activities provided by teachers. These factors are still relevant: A more recent study by Eret & Ok (2014) observed that the tendency to plagiarize is, in fact, increasing with the spread of the Internet, and pinpointed as main reasons for plagiarism time constraints, excessive workloads and high difficulty of the proposed assignments. These results are consistent in terms of reasons for plagiarism with the findings from Chen & Chou (2014) in a local study focusing on Taiwanese students. Another recent study from Hussein, Rusdi, & Mohamad (2016) found that students were widely aware of what plagiarism is, and that it is inappropriate. However, this would not deter students from plagiarizing for the other reasons mentioned. A more directed study from Kauffman & Young (2015) looked into how the ease of access to copy&paste tools and the presentation of the tasks influenced attitudes towards plagiarism.

In summary, most studies coincide in the interpretation that access to information has become so immediate that it is perceived by some as a «common knowledge» available for everyone to reproduce (Walker, 2010). These widespread issues have led to an academic/technological response seeking new ways and tools to detect plagiarism, as outlined in the next section.

1.2. Plagiarism detection tools

Many institutions approach the problem of plagiarism from the use of different methods to detect infringements. Such methods may range from the very simple (e.g. reverse-searching on Google, or any other general search engine) to the use of complex tools that perform more thorough checks. Some tools automate the process of reverse-checking. Two of the most commonly cited tools in this category would be Plagiarism Checker (<http://goo.gl/kElH>) and Article Checker (<http://goo.gl/GgYtQ>). Also in this category are CopioNIC (<http://goo.gl/B0C9R>), a free web application (requiring registration), that allows uploading files for search and Magister by Compilatio.net (<https://goo.gl/FqnPHb>) that allows both students and staff to upload documents and check their results online.

On the other hand, there are also products that create their own databases in which teachers can find the most interesting resources. Two examples could be Viper Plagiarism (<http://goo.gl/TrBey>) and Turnitin (<http://goo.gl/ixhp9>). The latter is one of the most widely used resources in the academic world, and compares new works with a large database of academic and web content, and its dominant position could grow to their recent merger with Ephorus (<https://goo.gl/PifnGN>), which is also present in many Higher Education Institutions. These tools are competing with other systems such as CrossCheck (<http://goo.gl/DFB0vQ>), which was originally created for scholarly articles, but is becoming another reference tool also for plagiarism detection in educational settings.

This thriving marketplace of plagiarism detection tools is apparently mature enough for detecting plagiarism not to be challenge. However, plagiarism cases remain common, even in situations where students are aware of the existence of these tools. Part of the problem may be related to the limitations of these tools, as identified by Vallejo (2011), including the fact that students may try to «trick» these tools, language limitations or an excessively burdensome process. Without ignoring the power of these tools, we argue that they are only part of the solution. It is important to complement these systems with changes in the methodology and with the promotion of good practices, looking for honesty and academic integrity.



2. Material and methods

The main objectives of this work are to gain a better understanding of why students plagiarize and to study whether changes in the presentation of academic assignments can have an impact in the rates of student plagiarism. The study was therefore organized in two stages: (1) a preliminary study to detect which tasks in an existing course presented higher levels of plagiarism and (2) a specific intervention aimed at reducing the rate of plagiarism among the students in those activities where plagiarism was more common.

The hypothesis is that it would be possible to reduce plagiarism by changing the presentation and statement of the activity, while maintaining the relative effort and educational design intact.

2.1. Target course and student populations

This research has been conducted in the context of the course «Mathematics - Complementary course», which is part of an Official Master's Degree in Elementary Education offered in a fully online modality at International University of La Rioja (UNIR). The assessment of this course is performed according to criteria set by the Bologna Process, trying to increase the importance of coursework activities vs. a final high-stakes exam. The course adopts a hybrid evaluation model in which the final qualification is composed of two parts: 60% corresponds to the in-person final exam; 40% is obtained from scores on a set of coursework activities presented by the student throughout the semester. Students are offered a wide set of activities and need to score 4 points in total. The maximum score of all combined activities is in fact 6 points, and students can therefore choose to focus on particular activities and are not forced to complete all of them.

Two student cohorts from the same course were taken into account in the two stages of this study: Group A: 65 students enrolled in the 2011-12 academic year; Group B: 94 students enrolled in the 2012-13 academic year. The students from Group A were the base for the preliminary study to detect how plagiarism affected the different assignments during the course. Then, after designing the specific intervention, these students were considered as the control group, while students in Group B were considered as the experimental group.

2.2. Background study: identifying and understanding plagiarism in an online course

As mentioned above, the first step in this research was to study the activities proposed for the continuous assessment of a course throughout the academic year, taking into account the rates of plagiarism. Students participated online through a virtual classroom, where all the activities and their corresponding maximum scores were provided. These were the activities proposed to students to earn the required 4 points of continuous assessment:

- Self-assessment quizzes: 14 self-assessment quizzes, with multiple-choice questions are offered, one for each of the lessons in the course, with a value of up to 0.05 points per each test.
- Attendance at online meetings: Attending at least two classroom meetings is assessed with 0.15 points.
- Participation in discussion forums: The forums request contributions and discussions among the students. The student may earn a maximum of 0.5 points, and the rating takes into account the number of interventions and their quality and relevance.
- Open ended assignments: These assignments include activities such as creating a glossary of mathematical terms, a study of geometry, statistical analyses, etc. There are different assignments, with values ranging from 0.5 points to 1 point each.
- Readings and personal proposals: Reading assignments focus on review articles, newspaper pieces, etc. and make a personal reflection. The student may earn a maximum of 1 point with each activity.



To develop our baseline study, we sampled the behaviour of the students in Group A (2011-12) to understand their participation rates and plagiarism trends.

2.2.1. Understanding student participation

As mentioned in section 2.1, students are not required to participate in all tasks. Each student can decide to focus on different assignments while ignoring others. In order to focus our effort on specific activities, we started by studying participation rates in the 10 possible assignments. Table 1 provides a breakdown of the delivery rates for each activity in the course. Although the preliminary study focused on Group A (2011-12), participation rates from Group B are also provided for comparison.

Activity	Type	Participation 2011-12	Participation 2012-13
1	Attendance at online meetings	89%	87%
2	Quizzes	82%	80%
3	Assignment: Create your own glossary	8%	20%
4	Forum: What are we thinking when we design a class?	57%	62%
5	Reading: First class numbers (prime numbers)	77%	83%
6	Reading: Reading a newspaper	68%	71%
7	Assignment: Geometry is everywhere	52%	67%
8	Assignment: Exploring Polyhedral	34%	35%
9	Assignment: Statistical project	5%	23%
10	Forum: Arithmetic or Geometry: Can you choose?	17%	22%

The activities that typically present a higher participation rate are the quizzes and attending online meetings. The relative simplicity of these activities and the flexibility for delivering them over the entire term may be two of the reasons that make their delivery rate so high. While these activities are not prone to plagiarism, they remain the most popular among students.

In turn, assignments and readings have varied results, with yield rates diminishing as the course advances and the difficulty increases. Activities 3 and 9, have very low rates and this may be due, primarily, to the fact that both activities involve searching across a variety of information sources, which involves a greater investment of time in completing the task.

2.2.2. Analysis of plagiarism

For this task, we ignored Activities 1 and 2, since they do not involve any production process by the students. In total, students submitted more than 350 activities during the year 2011-12. Given the time limitations faced during the course, we selected a random sample to assess plagiarism rates (up to 23 deliveries per task). The selection was performed randomly for each task, given that the specific students that choose to submit each of the assignments are different. In those activities where the total yield was lower, we included all the exercises delivered. All these activities were analysed using the Turnitin anti-plagiarism tool. The results are presented next grouped by activity.

- Forums: Among the activities submitted on the two forums, 36.36% included plagiarism. Although the percentage is not high, the kind of plagiarism was very serious, as it is an activity in which the task explicitly requested personal opinions.
- Open ended assignments: Activity 9 on creating a statistical project was only delivered by three students. It is noteworthy, nevertheless, that two of them are completely original, but the third presented a plagiarism rate of 31%. Activities 3, 7 and 8 have particular characteristics, as they ask for descriptions of mathematical content and therefore it is common to



use classical definitions, commonly accepted and displayed on many pages across the Internet.

- Readings and personal proposals: In Activity 6 plagiarism was not detected in any case. It is an activity that seeks to analyse the data from a current newspaper locating the various numbers and mathematical concepts that appear in it. Students chose all kinds of newspapers, focusing either on general news or specific topics, and the presentation of this activity was also varied delivering the data in both schematic tables and in more developed reports.

In turn, Activity 5 displayed much worse results. All samples (100%) presented matches with uncited or improperly cited sources (table 2). Seven of these activities (30.4%) included a plagiarism rate above 80%, with the worst case reaching 96%. Only five of the pieces of work analysed returned percentages below 25%.

2.2.3. Preliminary results

Data analysis shows that Activity 5 has the highest rate of plagiarism, combined with the highest participation rate after excluding quizzes and attending online lectures. It is so high that the blame cannot be attributed exclusively to the students who had not resorted to plagiarism in such a high proportion in the other activities. Remarkably, this activity focuses on a very specific topic, easy to look up on the Internet, barely related to news items and with very few direct applications in the classroom.

After careful analysis, and regardless of the unethical approach from some students, we have to consider the instructional design of the activity as flawed since it is eliciting such behaviour in wide populations of students that seemed capable of delivering original works in other assignments. In contrast, the effort required for the activity does not seem to be a determining factor in increasing plagiarism, since the activity that requested an analysis of the numerical elements of a newspaper was also a high-workload long task and had low rates of plagiarism.

Table 2: Percentage of plagiarism detected by Turnitin for Activity 5 in Group A

Students	Percentage	Students	Percentage
Student 1	19%	Student 13	85%
Student 2	33%	Student 14	11%
Student 3	22%	Student 15	24%
Student 4	38%	Student 16	23%
Student 5	40%	Student 17	38%
Student 6	42%	Student 18	42%
Student 7	44%	Student 19	33%
Student 8	69%	Student 20	44%
Student 9	80%	Student 21	54%
Student 10	80%	Student 22	79%
Student 11	83%	Student 23	96%
Student 12	83%		
Average		50.52%	

Having reviewed the various activities proposed and their characteristics, it can be seen that those which have a lower rate of plagiarism are the ones that imply a more personal involvement of the students with opinions and suggestions, as well as those in which the contents are linked to elements present in everyday life and closer to the student environment. In summary, in activities that encourage involvement, originality and creativity.

From these preliminary conclusions, we endeavour to check whether changes in the design (but not the deep meaning) of an activity can have an impact in plagiarism rates.



2.3. Intervention design

In this section the design of the experiment to reduce plagiarism is presented: after identifying the activity that had displayed the highest rate of plagiarism, this activity was redesigned and presented to a new student population (Group B). These students ($n=94$) were enrolled in the 2012-13 academic year, in the same course with the same agenda, planning, sequencing and evaluation.

2.3.1. Redesign of activity 5

Activity 5 was selected for the analysis of the hypothesis. The original design of the activity was in the form of an open text question with the implicit goal of having the students present a report with appropriate data in such a way that they could be used in a primary school syllabus. The statement of this activity was as follows (translated from Spanish):

- Reading: First class numbers: In the recommended reading for this chapter, the Devil of Numbers introduces Robert to some special numbers: those he was calling first class numbers. In the real world these numbers are called prime numbers and as our protagonist says «Mathematicians have spent over a thousand years puzzling over them. They are wonderful numbers. For example eleven, thirteen or seventeen...». Research the meaning of prime numbers and write a short essay presenting the key ideas about these numbers (definition, historical development, properties, curiosities...).

During 2012-13 academic year, the title and task briefing for the activity were modified, following some guidelines seeking to avoid plagiarism among students, according to the conclusions from preliminary study section. For this purpose, the activity was presented to students as follows:

- Reading: Explaining what first-class numbers are: In the recommended reading for this chapter the Devil of Numbers introduces Robert to some special numbers: those he used to call first class numbers. In the real world these numbers are called prime numbers and as our protagonist says «Mathematicians have spent a thousand years puzzling over them. They are wonderful numbers. For example eleven, thirteen or seventeen...». Research prime numbers, then we propose the following activity: Imagine you in front of a class of children between 9 and 10 years, to whom you have to explain briefly what the prime numbers are. Write half a side of paper (no more than 30 lines), on how would you explain it. If you wish, you may also add a picture or a diagram in the lower half of the sheet. Try to make it fun, original, educational, etc., remember that you are explaining it to children!
- Activity objectives: Be aware of the relevance for Mathematics of the primes; assume the role of teacher preparing (schematically) a class for elementary students; Design a motivating activity relevant to your future career as a teacher.
- Criteria for assessing the activity: The concepts presented and explained about prime numbers and their properties must be correct; the level of originality and creativity in the development of the class will be valued; Suitable writing and spelling.

The new design of the activity gives specific guidelines including the need to develop the activity for a real and relevant environment (Primary classroom). The activity is presented as a small piece of research which proposes data search, but requesting delivery of a personal proposal, which seeks student creativity, and not a mere list of the data found. The evaluation criteria explicitly present how to use the supporting materials and how the rigor and clarity of the content posted will be considered. With the new design of the activity, the student is aware that creativity will be assessed, but also is aware of the importance of correctness of the data provided. Most importantly, the evaluation rubric, expected completion time and delivery date remained equal to the original activity, only the task briefing changed.



2.3.2. Experimental design

The redesigned activity will be presented to students in the next academic year for comparison. Students from the 2011-12 academic year (Group A) will be considered as the Control Group, while students from the 2012-13 academic year (Group B) will be considered as the Experimental Group.

Once the course is completed, two important measurements will be taken:

- Measurement #1: An in-depth comparison of plagiarism rates in Activity 5, in order to understand whether the new design resulted in lower plagiarism rates. The plagiarism rates for each group will be analysed and compared using t-test comparisons to check whether there is a statistically significant variance in plagiarism rates.
- Measurement #2: A comparison among the two groups in other activities, to study whether the two groups were truly comparable in their day to day plagiarism practices and in their general performance. This second measurement is important in order to discard significant differences among the two groups (e.g. the experimental group may happen to be initially formed by students with stronger ethical principles in terms of plagiarism).

3. Results

While Group B was larger than Group A, their relative submission rates were reasonably similar, as observed previously in table 1. The two most notable exceptions were activities 3 and 9. Most relevantly, the average submission rate of activity 5 over the two academic years is over 75%. Despite the change in the design of the activity no significant changes were seen in the participation rate, maintaining a high percentage of submission.

3.1. Plagiarism rates (measurement #1)

The first step was to perform an in-depth analysis of all the deliveries of activity 5 in both courses. In total, there had been 50 submissions in the control group (Group A) and 78 deliveries in the experimental group (Group B), given that students are not required to submit all assignments. Figures 1 and 2 indicate the plagiarism rate found in each exercise submitted by both groups.

The results are remarkable, with very few students in the experimental group displaying any rate of plagiarism, and only two isolated cases displaying rates above 30%. As a result, as can be seen in table 3 the average plagiarism in the experimental group ($M=3.87$, $SD=10.26$) is much lower than the rate displayed by the control group ($M=47.66$, $SD=29.96$). This difference was found to be statistically significant, $t(56.4)=9.97$, $p<.000$, $d=4.39$). Levene's test for equality of variances was found to be violated, and therefore a t-test not assuming homogeneous variance was calculated.



Figure 1. Plagiarism rates in the control group

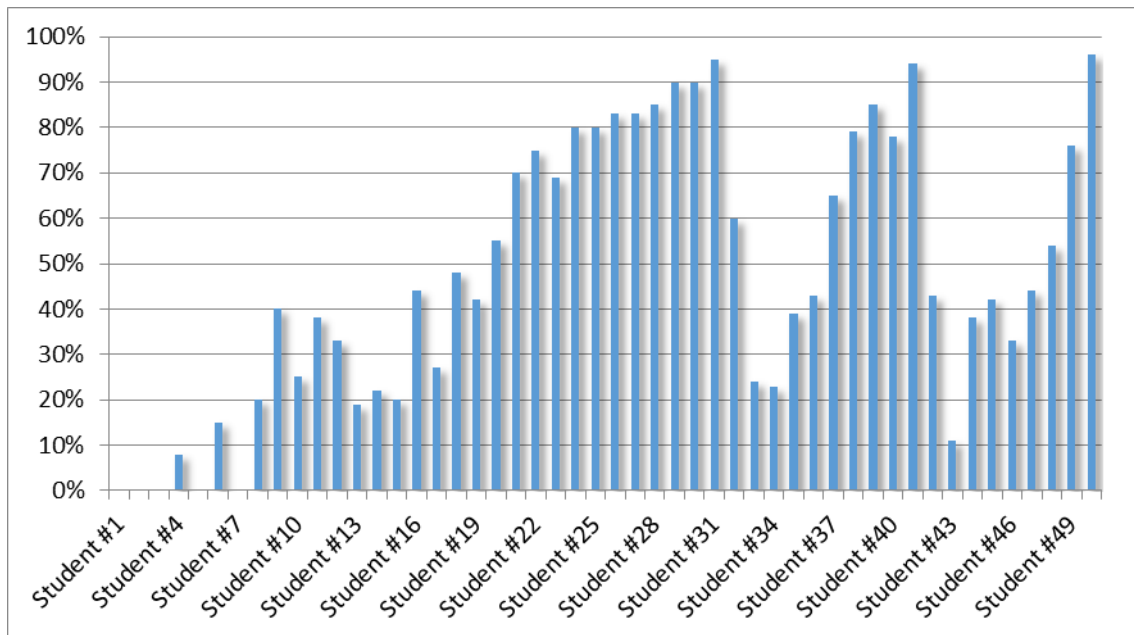
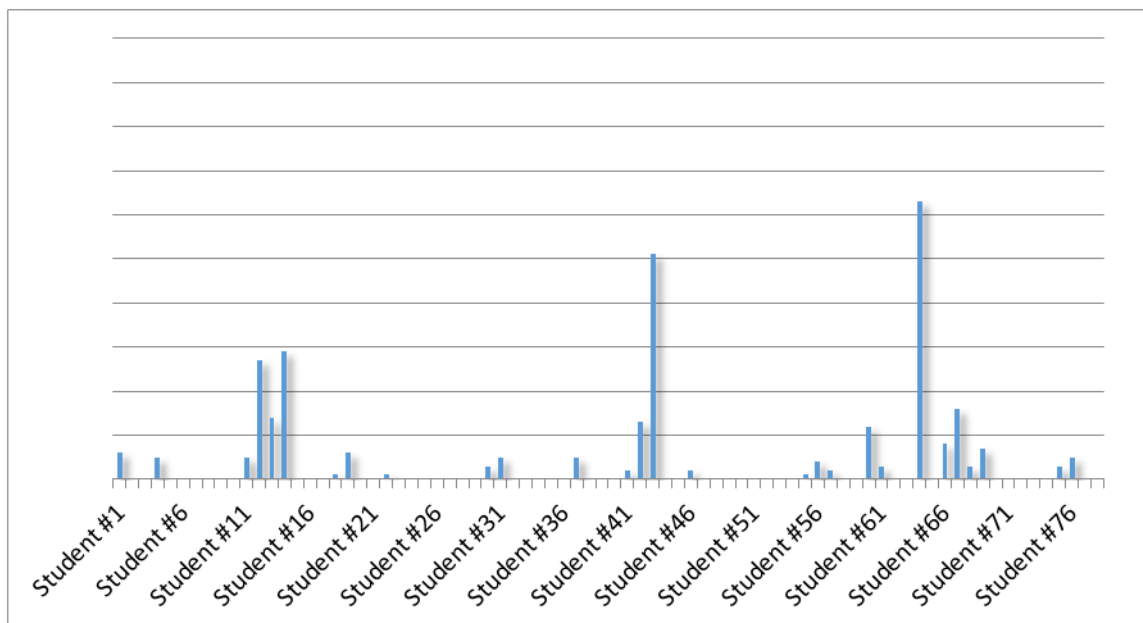


Figure 2. Plagiarism rates in the experimental group



3.2. Performance comparison (measurement #2)

While the analysis from plagiarism rates shows a significant improvement in the plagiarism rates, it was important to address whether both groups were truly comparable, trying to reduce any potential confounding factors. This was especially relevant given that the staff do not have access to demographic data from their student cohorts.



In table 1 it could be observed that the submission rates were reasonably aligned. In addition, we have also studied their performance in another activity to ensure that the two groups were certainly comparable. We have analysed the results for the activity with the second highest rate of coincidences, Activity 7, in which students must select a photograph and analyse mathematical elements that appear in it. This activity had a high degree of overlap, from multiple sources, usually without references, from which the students extract the definitions that accompany the photographs.

Control Group (2011-2012)	Average plagiarism	47.66%
	Standard deviation	29.96%
	Min. plagiarism	0%
	Max. plagiarism	96%
Experimental Group (2012-2013)	Average plagiarism	3.87%
	Standard deviation	10.26%
	Min. plagiarism	0%
	Max. plagiarism	63%

In this case, as observed in table 4, the experimental group performed slightly better ($M=22.09$, $SD=6.24$) than the control group ($M=28.82$, $SD=6.01$), a difference of only 6.73% that was found to be not significant during the statistical analysis.

Control Group (2011-2012)	Average plagiarism	28.82%
	Standard deviation	6.01%
	Min. plagiarism	0%
	Max. plagiarism	80%
Experimental Group (2012-2013)	Average plagiarism	22.09%
	Standard deviation	10.26%
	Min. plagiarism	0%
	Max. plagiarism	85%

4. Discussion and conclusion

Based on the growing interest that plagiarism is receiving in Higher Education contexts, this work has focused in understanding why and how students plagiarize, and in exploring constructive approaches to reducing plagiarism.

We started with a study of plagiarism patterns in an online Master's degree, observing and discussing how each type of assignment resulted in different plagiarism rates. In this preliminary study, we identified which tasks were more prone to plagiarism and tried to alleviate this situation by trying to promote an internal motivation to be creative, as opposed to increasing the severity of our potential coercive methods. This resulted in our main experiment, in which we changed only the instructions of the assignment, but neither the purpose of the task nor the evaluation rubric.

The results present a very obvious difference between the experimental group and the control group, indicating a very strong effect of how the exercise was worded. This indicates that the approach taken by staff had a profound impact in the students' attitude towards the exercise.

We believe that it is especially remarkable that the students did not receive any especial threats warning against plagiarism other than the usual that all groups receive at the beginning of the course. This contrasts with many of the existing perceptions about why students would cheat: laziness, difficult tasks, lack of understanding of the moral implications, etc. In this test, we elicited a positive response from our students substituting the usual approach (threats of consequences if caught cheating) with a proposal that dared them to be creative and original.



This study therefore shows that it is possible to reduce the incidence of plagiarism by designing activities in such a way that students are prompted to propose their own ideas, and in which they approach the search for information already available on the Internet as a vehicle for their solutions, but not the main task. It should be noted, however, that this experiment has achieved one of the desired objectives by reducing plagiarism, but the ethical dimension has not been tackled: many of our students still do not understand the ethical implications of plagiarism, and the Internet appears as a large repository of information without any implication. A deeper exploration of the ethical dimension of academic work remains necessary, with a focus on rigour, recognition and valuation of intellectual property, teaching students to respect the work of others as a starting point, but not a final reproducible product.

Finally, we acknowledge that the proposed improvement is limited in terms of the sample size and the elements of comparison, but may be the basis for a more comprehensive study that should expand the study population and may include activities from different courses, degrees and teaching modalities (e.g. online vs. face-to-face). In addition, this study is local to a specific university and language, and should be cross-referenced with other international studies.

The world changes and teaching processes should try to change to keep pace, either through new regulations or teaching methods. We believe that we may have shed some light into the thought process that prompts our students to plagiarize with such carelessness, demonstrating that the solution does not only lie on coercive methods, and that there is room for positive approaches.

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