

Plagiarism and use of technology by high school students

Plagio y uso de tecnología en estudiantes de secundaria

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ABSTRACT. The use of the different tools and resources available on the web has the potential to affect the level of plagiarism at all educational levels. This article approaches the relationship between the use of Internet resources and the levels of plagiarism among high school students in Ecuador. Quantitatively, 16,546 surveys of high school students were conducted and the students were classified using the k-means method according to the use of Internet tools. Cause-effect relationships were established through logistic regression between classifications and the levels of plagiarism. The results show that Internet skills and student confidence in the Internet directly affect plagiarism levels. It was found that plagiarism depends on the confidence levels of the students and on the variables connection days per week, level of Internet knowledge, hours connected per day and years of experience as an Internet user.

RESUMEN. El uso de las diferentes herramientas y recursos de la web tiene el potencial de afectar el nivel de plagio. Este artículo aborda la relación entre el uso de recursos de Internet y los niveles de plagio entre estudiantes de secundaria en Ecuador. Cuantitativamente, se realizaron 16.546 encuestas a estudiantes de secundaria y se clasificó a los estudiantes mediante el método de k-medias según el uso de herramientas de Internet. Las relaciones causa-efecto se establecieron mediante regresión logística entre las clasificaciones y los niveles de plagio. Los resultados muestran que las habilidades de Internet y la confianza de los estudiantes en Internet afectan directamente los niveles de plagio. Se encontró que el plagio depende de los niveles de confianza de los estudiantes y de las variables días de conexión a la semana, nivel de conocimiento de Internet, horas conectadas por día y años de experiencia como internauta.

KEYWORDS: Internet, Plagiarism, Technology, High school, Academic success.

PALABRAS CLAVE: Internet, Plagio, Tecnología, Colegio, Éxito académico.

1. Introduction

As discussed in "The Purdue Online Writing Lab" (OWL), cited by Maddox (2011), there are few intellectual crimes more serious than plagiarism in academic and professional contexts. Plagiarism is defined by the RAE (Real Spanish Language Academy, 2014) "as an action of copying the works of others, specifying in the action how to copy in substance the works of others, giving them as their own". This action is considered a lack of ethics in good academic practice and, depending on the legislation, could even incur a greater penalty of imprisonment (Al-Thwaib, Hammo & Yagi, 2020). Plagiarism is seen as a growing problem in academia, and is often discussed in the personal terms of a "lazy modern" student (Eriksson & Sullivan, 2008). In a legal-historical context (Sutherland-Smith, 2008) he argues that plagiarism in writing has been rampant since the appearance of the printing process with Gutenberg in 1450, with the notion of "individual possession" emerging later (1710) as a right, and that a person's ideas were legally considered "property", thus giving rise to the legal protection of property rights. In the 19th century with the industrial revolution, the oldest international agreement designed to protect the creators of literary and artistic works is reached, called "The Berne Convention", whose last revision was made in 1979 (Shtefan, 2019). Finally, in view of the requirements of the current digital age, the "World Intellectual Property Organization" (WIPO) was created, which updates the "Berne Convention". It is from this context and the notions of copyright that the legal concept of plagiarism appears in universal level (Pàmies, Valverde & Cross, 2020).

Since the beginning of the 21st century, with the boost of the fourth industrial revolution, plagiarism has had all the necessary elements to develop and spread, and the Academic life has been one of the spaces where its practice is expanded (Keefer, Brown & Rothschild, 2020). On the one hand, the creation of content has grown at exponential rates, in 2016, 44 billion GB of information were created per day, by 2025 this amount will reach 463 GB (Schultz, 2019). In addition, the existing tools that makes possible to access this information, such as: search engines, are becoming more versatile and have greater capacity to discern what the user wants to look for; and it is precisely this set of tools, that helps the plagiarism to be spreaded and have greater reach (Roostae, Sadreddini & Fakhrahmad, 2020; Kukatlapalli, Doyle & Bandyopadhyay, 2020). This paper seeks to determine the incidence of the use of Internet tools on the levels of plagiarism among high school students in Ecuador.

2. Literature review

Sutherland-Smith (2008) makes a theoretical proposal of plagiarism from a continuous model, in which he relates the points of view of teachers and students, and their interpretation and understanding of plagiarism from three non-exclusive areas: laws, theory originating in scientific literature, and socio-cultural studies. It is continuous because of the dynamic form of movement in the thought development, in which people and institutions perceive plagiarism in different ways, with mixed ideas of what constitutes plagiarism (Sutherland-Smith, 2011).

According to "The Council of Writing Program Administrators (WPA)" (Maddox, 2011), it is necessary to make distinctions between plagiarism and misuse of sources, since students are not guilty of plagiarism, when they try, in good faith, to recognize the work of others but do not do so accurately or completely, because of failures in teaching and learning about it (Adler-Kassner, Anson & Howard, 2008).

Social norms, interaction environments, and the education the individual receives about ethical behavior regarding plagiarism are directly related to this practice, as demonstrated (Isakov & Tripathy, 2017), conclude that 1) context-dependent rewards, compensate for cheating; 2) reminders of social norms leads to a sincere and honest self-reporting; 3) males seem to cheat more than females; and 4) teenagers are more dishonest at the beginning of the day. Cheung, Wu and Huang (2016) suggests that: contextual aspects, such as participation and task orientation, as well as personal contexts with more intrinsic and utility value are associated with students' attitudes toward the acceptability of cheating behavior. Kam, Hue and Cheung (2018) positively relate intention to cheat, attitudes towards cheating, control of perceived behavior, and moral obligation, but only the subjective norm against cheating was significantly related to self-reported cheating

behavior, making this variable a predictive factor. Hakim et al. (2018) determines the effect of alienation, as an emerging factor to be considered in the academic dishonesty of students (Newman, 2020).

Plagiarism is the most common problem for students (Pizzolato, Abdi & Dierickx, 2020), when they write their research home works (Baysen, Baysen & Çakmak, 2017; Liu, Xu & Ouyang, 2015). Students' dishonest behavior is highly related to their parents' academic performance levels and education (Naaaj & Nachouki, 2019; Błachnio, 2019; Birks et al., 2018), and in part to their gender (Vonkova, Bendl & Papajoanu, 2017; Arias-Chávez et al., 2020; Bokosmaty et al., 2019; Jereb et al., 2018; Jereb et al., 2018a). Regarding gender Sureda-Negre, Comas-Forgas and Oliver-Trobat (2015), concludes that "at the pre-university level (n= 2,794), men have significantly higher levels of perpetration than women". In contrast, a study by Chang, Chen, Huang and Chou (2015) on boys (n= 41,911; age= 10-18 years) in Taiwan, shows no difference between male and female in plagiarism-related behavior. Sex, as a universal discriminating factor, is not considered a determinant of behavior (Tindall & Curtis, 2020).

Plagiarism occurs at all educational levels: pre-school (Yang et al., 2014; Olson & Shaw, 2011), primary (Kahya, Saricaoglu & Yakar, 2019), secondary (Chu, Hu & Ng, 2019; Kam, Hue & Cheung, 2018) and higher education (de Maio, Dixon & Yeo, 2020; González-González et al., 2020; López-Gil & Fernández-López, 2019). In first year students (Šorgo, Vavdi, Cigler & Kralj, 2015) from applied questionnaire (n= 323) the result was that cheating is a way of life in the Slovenian schools, and that almost all students at least occasionally, self-indulge in some academic misbehavior, without significant gender differences and other socio-demographic variables. This study highlights the fact that, behind the assumption of "helping" to climb the ladder of success, a tolerant culture has been established, which supports this type of behavior among students, parents and teachers. Non-experimental longitudinal studies (Macale et al., 2017) show that: students become accustomed to taking actions that are academically misleading, even if their behavior is considered acceptable and normal, and becomes routine, which increases later misleading behavior. In Sutherland-Smith's study (Sutherland-Smith, 2008), for some institutions, the intention of the students is irrelevant, while for others, they value the intention, being considered as a trap when identifying intentionality; and as a minor academic offence the unintentional plagiarism of "not citing a source correctly"; in the most severe contexts, institutions with a policy of zero tolerance, the sanction is automatic expulsion (Melo, Soto-Ardila, Luengo & Carvalho, 2020).

In high school environments, plagiarism refers to a detriment to the public perception of standards of academic excellence, regulating the ways in which it will be treated in their individual environment through their plagiarism policies, ethics committees or honor codes (Shmeleva & Semenova, 2019; Vargas-Franco, 2019).

A study by Sureda-Negre et al. (2015) confirms that plagiarism is certainly present and widespread in secondary classrooms. Baysen et al. (2017) focused on a select group of International Baccalaureate (IB) students, with the objective of improving knowledge about academic honesty and related skills, to eliminate misconceptions related to plagiarism; 3 Likert-type tests are applied to the population (IB = 114, not IB 225) with better results for the IB group in terms of academic honesty.

To face academic dishonesty, the TeSLA project (Peytcheva-Forsyth, Aleksieva & Yovkova, 2018), funded by the European Commission, has defined and developed a system that ensures authentication of student identity and authorship in online and mixed learning environments (Gaňan, 2020); researches the impact of technology on plagiarism from the perspective of professors and students at the University of Sofia (Bulgaria), concluding that technology affects plagiarism and generally dishonest behavior, because, it offers different tools that facilitate such behavior. They also point out that digital media change the ways in which cheating takes place rather than affecting levels of academic dishonesty (Peytcheva-Forsyth et al., 2018).

Chen and Ku (2008) address the relationship of some variables to plagiarism: gender, computer accessibility, computer proficiency, English proficiency, self-efficacy, teacher reinforcement and student understanding of plagiarism. The study was carried out with 235 EFL students with an average age of 21.5

years, applied anonymously a) Bandura's Scale of Self-efficacy for Self-regulated Learning (Bandura, 1990) and b) self-report survey on students' perceptions and experiences with plagiarism (Chen & Ku, 2008); it was found that students' self-efficacy scores did not correlate with their plagiarism frequencies. Regarding computer/Internet access, about 91% of individuals have a personal computer, of which 80% have reported that the primary source of plagiarism, was the Internet.

In all the literature reviewed, no studies have been found that address the problem of plagiarism from the context presented in this study. Some of the proposed variables have been related to varying degrees: age, sex, income level, academic uses, entertainment uses, confidence levels and skill levels (Belli, Raventós & Guarda, 2020).

The proposal is original; however, it has a large background of preliminary studies that allow establishing the space for scientific discussion. The proposal is based on a methodology sustained in the relationship of two groups, obtained from variables related to the academic use of technology: 1) low academic intensity, and 2) high academic identity; three groups obtained from variables related to the use of technology for entertainment: 1) passive, 2) interactive, and 3) video and games; and two groups from the perceptions of the level of trust in information and the Internet: 1) trust in information, 2) internet facilitates learning, and 3) Internet improves grades. From these three groups, a regression model is established to establish the relationship from these groups with the practice of plagiarism.

3. Methodology

The hypotheses raised in this paper are two:

- a. There is an incidence of Internet uses, both academic and entertainment, on the level of plagiarism.
- b. There is an incidence of trust in the Internet and the skills in the use of technology, in the student, about the levels of plagiarism.

3.1. Population and sample

A sample was taken from 52 public and private schools in Ecuador, which allowed compiling a total of 16,546 surveys between April and July 2019. The respondents were students between 12 and 20 years old, the sample includes 1.6% of people from older ages that correspond to night schools where older students are found. The gender distribution was 50.7% men and 49.3% women.

3.2. Data-gathering instruments

The applied questionnaire is based on the validated questionnaires developed for the Internet Catalunya project (UOC, 2003), Internet use and academic success in university students (Torres-Díaz, Duart, Gomez-Alvarado et al., 2016) and Plagiarism, Internet and academic success at the University (Torres-Díaz, Duart & Hinojosa-Becerra, 2018). A pre-test was conducted with 30 students who had no problem understanding and completing the survey; after the pre-test, physical surveys were carried out in the classrooms of the different schools. The physical surveys were digitized through a Google Docs form and downloaded in SPSS format for processing.

3.3. Procedure

Students were classified according to: use of technology for academic activities, use of technology for entertainment, student confidence in web information, and student skills using technology. Groups were formed by applying cluster analysis (k-medias) to discover the underlying structures that classify students.

First, a classification is developed that measures the intensity of technology use in academic activities. The variables used for this classification are detailed in figure 1. The second classification is based on the uses of technology for entertainment, the variables used can be seen in figure 2. A third classification groups the students according to the level of confidence they have in the information and in the Internet tools, the variables

of this classification can be seen in figure 3. Finally, the students are classified according to their skill level, figure 4 shows the variables involved in this classification.

To verify these hypotheses, dependency relationships were sought by applying “The chi-square statistic” and binomial logistic regression. The four independent variables tested were constructed from other variables obtaining classifications from cluster analysis.

4. Results

4.1. Student overview

Only 8.5% of students go online one or two days per week. More than half of them (53.8%) are on line every day. 81.5% have a phone with some kind of Internet connection. About 77% have a computer (with and without connection); on the other hand, those who use public services (cyber cafe), is a minimum proportion (15.5%) of those who have some type of particular connection. Students were asked about their level of Internet knowledge, on a scale of 1 to 10, where 1 is knowing nothing and 10 is considered an expert; results show that knowledge levels equal to or less than 5, comprise 21.8% of students; the remaining 78.2% is between 6 and 10 implying a general high level of knowledge.

4.2. Categorization

It was necessary to categorize the academic use that the student gives to the different tools and resources, to support himself in the academic activities, for this purpose, groups were created using cluster analysis on the variables in figure 1.

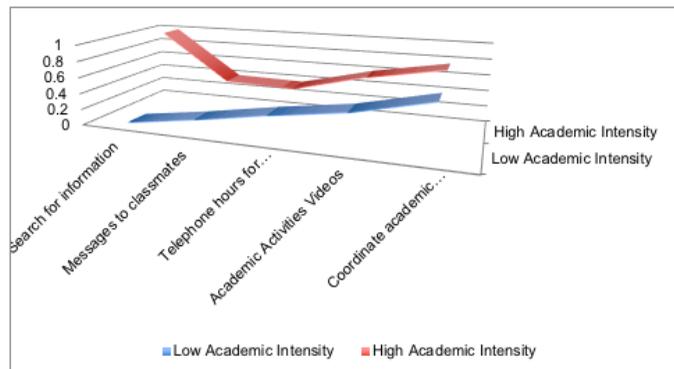


Figure 1. Internet use for academic activities. Source: Self-made.

The results of this analysis show two groups: the low academic intensity group, 62% of the total students, and has as characteristics: a low level of information search and messages to peers, while in the other variables, it has a slightly lower behavior than the students of the high academic intensity group.

The high academic intensity group represents 38%, these students have the highest values in all the variables, which is an indicator of a higher use; the time they spend looking for information and using the phone and messaging to coordinate academic tasks and activities, is highlighted.

We worked on developing a classification that group together students based on their uses of technology for entertainment purposes. Cluster analysis was applied to the variables in figure 2 and the groups that can be observed, we obtained:

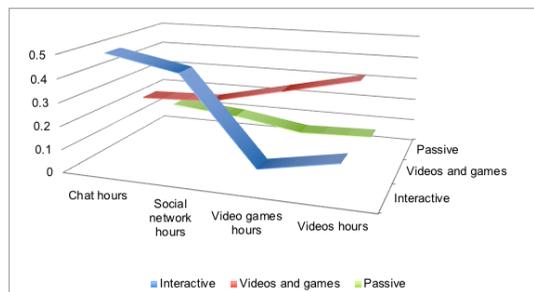


Figure 2. Internet use for entertainment activities. Source: Self-made.

Three groups were identified in this classification: the first is called “interactive” and has more time dedicated to chat and social networks, this group represents 16% of the students; the second group is called “videos and games” because it dedicates more hours to video games and watching videos online, this group covers 9%; finally, the “passive group”, which has less time dedicated to the four variables, this group is 75% of the students.

Additionally, we generated a classification that measures perceptions and determines a level of confidence in the information and the Internet, the variables used are those observed in figure 3.

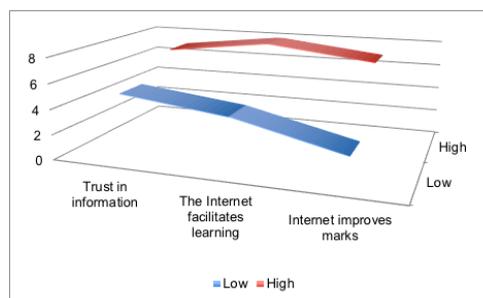


Figure 3. Confidence levels. Source: Self-made.

Two groups were identified, which were called: “high confidence” which has higher levels in all variables, in this group 65% of students are involved; the second group was called “low confidence” which has lower levels, this group covers 35% of students.

A final classification divides the students into two groups, those with a medium skill level and those with a high skill level (Figure 4).

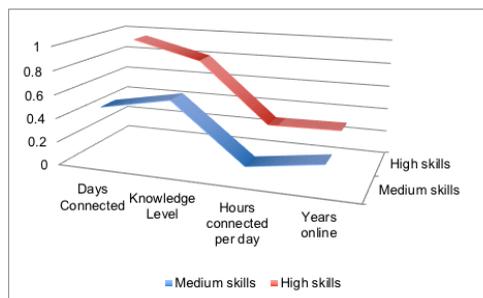


Figure 4. Level of internet use skills. Source: Self-made.

4.3. Dependency relationships: Academic groups

The use of the Internet for academic activities shows a dependency in which the older the person, the

greater the probability of belonging to the high academic intensity group ($X^2=1015.2$, $p<0.05$); something similar occurs with the gender variable, men have a greater probability of belonging to the high intensity group ($X^2=27.6$, $p<0.05$); and finally, income has a significant influence, the greater the resources of the family, the greater the probability of the student to belong to the high intensity group ($X^2=21.4$, $p<0.05$).

4.4. Dependency relationships: Entertainment groups

Analyzing the dependence of internet use for entertainment with respect to the gender of the student, it was found that women are more likely to belong to the interactive group, men are more likely to belong to the games and videos group and men are more likely to belong to the passive group ($X^2=96.4$, $p<0.05$). This classification is also affected by income level, the higher the income the higher the probability of belonging to the interactive and video and games groups, while the probability of belonging to the passive group decreases ($X^2=448.7$, $p<0.05$). Thus, as age increases, the probability of belonging to the interactive group also increases; the probability of belonging to the games and videos group also increases until the age of 17, and then it experiences a decline; the probability of belonging to the passive group increases in the youngest ones ($X^2=330.9$, $p<0.05$).

4.5. Dependency relationships: Confidence groups

Students' confidence in the Internet is dependent on income level, as this increases the probability of belonging to the high confidence group ($X^2=204.5.9$, $p<0.05$). Males are more likely to belong to the high confidence group ($X^2=61.5$, $p<0.05$). On the other hand, age also affects the level of confidence, the older the age, the higher the level of confidence ($X^2=246.5$, $p<0.05$).

To verify the hypotheses of the investigation, different relationships were established between the categories constructed with cluster analysis and the plagiarism dependent variable. It was determined that there is no significant relationship between plagiarism and the academic uses that the student makes of the technology; also, there is no any relationship between plagiarism and entertainment uses. Dependence of the variables "confidence level" and "skill level" of the student was found (Table 1).

	B	E.T.	WALD	GL	SIG.	EXP (B)
Confidence	-.887	.046	372.481	1	.000	.412
Skill	-.305	.047	41.418	1	.000	.737
Constant	2.268	.035	4269.090	1	.000	9.664

Table 1. Regression model coefficients. Source: Self-made.

The interpretation indicates that the Odds Ratio (OR) of not plagiarizing with respect to doing, is 2.42(1/0.412) times lower when the student belongs to the low confidence group with respect to the high confidence group (OR=0.412, (95% CI 0.613 - 0.671)), this can be interpreted: as the level of confidence of the students in the Internet decreases, the probability of plagiarism also decreases. The OR of not plagiarizing with respect to doing so is 1.35 (1/0.737) times lower when the student belongs to the medium skill group with respect to the high skill group (OR=0.737, (95% CI 0.820 - 0.899)), this can be interpreted as follows: as the level of students' Internet skills decreases, so does the level of plagiarism.

To go deep into the relationship between the variables of the classification "confidence", the table 2 shows the correlation and determination coefficients; we can see that the confidence in "Internet allows you to improve your scores", is the variable with the greatest incidence on the level of plagiarism, followed by the variable "confidence in information from the Internet" and finally the variable "the Internet facilitates learning".

	Trust in information	Facilitates learning	Improve qualifications
Correlation	.276**	.252**	.286**
Determination	0.076	0.064	0.082

** Correlation is significant at the 0.01 level (bilateral).

Table 2. Plagiarism relationships. Source: Self-made.

About to the classification "skill", the level of incidence of these variables on the level of plagiarism can be seen in the table 3. The incidence in general, despite being significant, is minimal.

	Connection days	Internet Knowledge	Hours connected	Years Connected
Correlation	.119**	.093**	.064**	.042**
Determination	0.014	0.009	0.004	0.002

** The correlation is significant, at the 0.01 level (bilateral).

Table 3. Plagiarism and skill variables. Source: Self-made.

5. Discussion and conclusions

The use of the Internet for academic activities divides students into two groups: those who use it at low intensity and those who use it at high intensity. The low-intensity group is notable for students watching academic videos and coordinating with their peers on academic activities. Students in the remaining group spend more time on the different variables analyzed. Dedicating more time is related to the student's age, the older the student, the more time is dedicated. This means, as the years of study increase, students use technological tools more intensively; this could be due to the fact that the student is becoming more familiar with technology and acquiring habits of use. Spending more time using technology for academic purposes shows a higher proportion of men, and those at higher income levels also spend more time. This is explained by the availability of resources, whether these are computers or adequate connections that allow students to stay connected. The levels of use of technology for academic activities have no incidence on the levels of plagiarism.

An additional ranking shows that 75% of students use technology minimally for entertainment, the remaining students are divided into those who use video games and watch videos with 9% and those who interact through social networks with 16%. These figures generally show passive students using technology for entertainment, the data shows that this is due, among other variables, to the economic level of the students' families; age also plays a role, the younger they are, the more passive.

In this work, we also analyzed the confidence of students in the information and tools offered by the network, it's very interesting that: the level of confidence is directly related to the income level, the higher the income, the higher the level of confidence; the explanation is given by the ease of access, that causes greater student experimentation with the tools and information; the same explanation applies to the relationship that indicates that, as age increases, the level of confidence also increases. There is no empirical explanation of why men trust the information and tools of the network more than women.

As in a similar study conducted for universities (Torres-Diaz et al., 2018), in this paper we found: at higher income levels the level of plagiarism increases. Plagiarism levels are more prevalent among men than women, which is consistent with a similar study in high school students (Sureda-Negre et al., 2015) where men have significantly higher levels of plagiarism than women.

Regarding the hypotheses raised, the uses of the Internet for both academic and entertainment purposes have no impact on plagiarism. It was found that plagiarism depends on the skill levels and confidence levels of the students. When talking about skill, a minimal but significant incidence of the variables is found: days connected per week, level of Internet knowledge, hours connected per day and years spent as an Internet user, there is a coincidence here with the study by Torres-Diaz et al. (2018) where something similar happens with the difference that it's about college students. The student's confidence in the Internet has a positive incidence on the level of plagiarism, this incidence is higher than that presented by the variables of the "skill" classification. It called our attention that the variable: "Internet allows you to improve your grades" is the most influential on the level of plagiarism, it could be said: that this variable works together with the variable: "trust in Internet information" which would explain the relationship, in any case, it is necessary to go deeper into the research by collecting information from variables that expand or break down the student's perception of trust.

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