Factors Influencing Graduate Students’ Preference of Software Tools for Building Engineering Applications*

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Based on previous research on technology acceptance models, the purpose of this study was to examine the effect of four variables (perceived ease of use, perceived usefulness, output quality and enjoyment) on students’ intentions to use Google Drive Spreadsheet and Arquimedes software for budgeting and measurement purposes in the Building Engineering context, as well as students’ preferences to use each program. A sample of 92 students received training in both programs and evaluated them. Results suggest that students prefer Google Drive Spreadsheet in the academic context and Arquimedes in the professional context. Findings also show a significant effect of perceived usefulness and output quality on usage intentions of both applications, as well as an effect of output quality on perceived usefulness. However, with respect to the rest of variables, differences were found between Google Drive Spreadsheet and Arquimedes. While in the case of Google Drive Spreadsheet perceived usefulness and output quality worked as mediators of enjoyment, and perceived ease of use had no significant effect on any variable, in the case of Arquimedes all the variables had a significant effect on usage intentions. These results suggest that when a technology is perceived as very easy to utilize, such as Google Drive Spreadsheet, perceived ease of use has very little or no impact on individuals’ intentions to use that technology. Findings are discussed in terms of its implications for practice and further research.

Keywords: technology acceptance models; technology usage intentions; higher education; building engineering; software application

1. Introduction

Nowadays it is difficult to conceive the university without the use of technologies. They are as omnipresent as reading, writing and arithmetic [1], and provide a solid base for quality education [2–4]. They are considered to be powerful tools for change and educational reform [5]. Nevertheless, Information and Communication Technologies (ICT) are not the panacea for all the problems in higher education [1, 4], since, by themselves, they do not guarantee a positive change in the university. ICT must be well implemented in the classroom, and be accepted by students. In this regard, technology acceptance theories have been used to know whether students accept or not technologies, and how and why individuals adopt new information technology [6]. Over time, several models which examine key determinants of user acceptance have been developed. For instance, the Three-Tier Use Model (3-TUM) [7] which is based on Liaw and Huang’s model [8]; the Unified Theory of Acceptance and the Use of Technology (UTAUT) [9], which was born from the thorough study of eight models of technology acceptance; the Technology-to-Performance Chain (TPC) [10], and the Technology Acceptance Model (TAM) [11]. Most of these models have had a wide impact on ICT in the educational field, especially in e-learning [6] and m-learning contexts [12, 13]. The present work takes as a reference the study conducted by Davis, Bagozzi and Warshaw [14] that was inspired, in turn, by TAM.

2. Theoretical foundations

The Technology Acceptance Model (TAM) is based on the Theory of Reasoned Action (TRA) developed by Martin Fishbein and Icek Ajzen [15, 16]. TRA is a theory of human behaviours, and comes from the social psychology field. TRA suggests that a person’s behavioural intention depends on two factors: his attitude toward the behaviour and his subjective norm. A person’s attitude toward performing a given behaviour is related to “his beliefs that performing the behaviour will lead to certain consequences and his evaluation of those consequences” [16, p. 16]. The subjective norm is the belief that certain referents (people who are important to the individual) think the person should or should not perform the behaviour in question, and the motivations to comply with these expectations, i.e. the perceived social influence of people who are important to the individual. Based on this theory, the Technology Acceptance Model (TAM) has been widely applied to a diverse set of technologies and users [9], proving to be a powerful and robust...
predictive model [17]. It is, in fact, the most-used theory in the e-learning acceptance research [6].

TAM was developed by Davis [11] and seeks to predict and explain the individual’s behavioural intention to use a technology through two specific behavioural beliefs, which are theorized to be fundamental determinants of system use: perceived usefulness and perceived ease of use. According to Fishbein and Ajzen [16, p. 288], *behavioural intention* refers to the “individual’s subjective probability that he or she will perform a specified behaviour”. Davis [11, p. 320] defines *perceived usefulness* as “the degree to which a person believes that using a particular system would enhance his or her job performance”, and *perceived ease of use* as “the degree to which a person believes that using a particular system would be free of effort”.

TAM has evolved through several studies [11, 18, 19]. Fig. 1 represents the final model developed by Davis [11], which posits that computer usage is determined by behavioural intention, and behavioural intention is jointly determined by the person’s attitude toward using the system and perceived usefulness. In addition, TAM postulates that perceived usefulness and perceived ease of use have an effect on attitudes, but perceived usefulness has a direct effect on behavioural intention over and above attitudes as well. Besides, perceived ease of use has an effect on perceived usefulness. Finally, there are some external factors (e.g., anxiety, experience, subjective norms, system quality) which may have a significant influence on users’ perceptions (usefulness and ease of use) when they utilize a technology. The relations of these variables have been recently studied in the meta-analysis carried out by Šumak, Heričko and Pušnik [6]. This study suggests that TAM-related relationships are mostly supported in existing e-learning acceptance research.

Davis, Bagozzi and Warshaw [19] found that attitudes intervened between beliefs (perceived usefulness and perceived ease of use) and intentions far less than hypothesized by TAM. There is no agreement whether the variable attitude toward using the system has an influence on behavioural intentions. Some studies do not take into account this variable in their acceptance models of the technology [14, 20, 21], while others suggest that attitudes affect on behavioural intentions [22, 23].

Besides the above-mentioned variables, some authors state that there are other factors that can affect on the acceptance and use of a technology. Enjoyment, also known as intrinsic motivation, is one of them [7, 24, 25]. Traditionally, motivation theorists distinguish between two broad types of motivation when performing an activity: extrinsic and intrinsic motivation [e.g., 26, 27]. In general terms, extrinsic motivation refers to the performance of an activity in order to obtain a reward or valued outcomes that are distinct from the activity itself [28], whereas intrinsic motivation is the satisfaction and pleasure of performing a specific activity [29]. In this sense, *enjoyment* refers to the extent to which the activity of using a specific system is perceived by the subject as enjoyable, apart from any performance consequences that may be anticipated [14, 30]. For instance, perceived usefulness is an example of extrinsic motivation, while enjoyment is an example of intrinsic motivation [14].

Research suggests that motivation is an important factor driving perceptions and behaviour [8, 22]. However, there is no agreement yet about where the theoretical construct enjoyment should be located with respect to the rest of the variables. On one hand, Davis, Bagozzi and Warshaw [14] concluded that perceived usefulness and enjoyment had a significant effect on individual’s behaviour intentions to use a technology. It was also found that perceived usefulness was a stronger determinant than enjoyment. On the other hand, findings revealed that perceived ease of use and output quality affected both perceived usefulness and enjoyment. Others [7] also support the idea that enjoyment has a direct influence on behavioural intention. Venkatesh [22] carried out a study using two types of teaching strategies: traditional teaching methods and teaching based on video games. This work aimed to analyse the influence of enjoyment in TAM and revealed that perceived ease of use and perceived usefulness determine individuals’ behavioural intentions, while enjoyment has an effect on perceived ease of use. According to the author, these results suggest that users that have a pleasant training experience are more likely to perceive the

![Fig. 1. Theory Acceptance Model (TAM) [11].](image-url)
systems as easy to use, having this condition an effect on their usage intentions. There are other studies, however, that suggest that enjoyment has an effect on perceived usefulness and the latter on behavioural intentions to use a specific technology [8, 31]. That is, the more a person enjoys using a technology, the more useful he or she will perceive that technology.

Like enjoyment, the variable output quality was not taken into account in TAM. Nevertheless, we believe that the perceived quality of the product of using a specific technology may determine individuals’ behavioural intentions to use it. According to Davis, Bagozzi and Warshaw [14, p. 1115], quality may be “judged by observing intermediate or end products of using the system”. They suggest that output quality affect perceived usefulness and enjoyment, and these two variables have an effect on behavioural intentions of using the system. Liaw and Huang [8] refer to the quality of the system as a whole, including not only the quality of the system itself but also the output quality. In this regard, research suggests that the quality of the system affects indirectly usage intentions through other variables, such as enjoyment and perceived self-efficacy [7].

As seen above, literature shows a wide range of research regarding technology acceptance theories and, particularly, about TAM. Most of these studies try to analyse the effect of some variables on individuals’ behavioural intentions to use a specific technology and have suggested modifications to the original model by introducing external and internal variables [32]. Nevertheless, there is not an agreement yet about which are the final factors that should be included in the model and what are the effects of these variables on usage intentions. Therefore, the present work aims to add new understanding and knowledge to technology acceptance theories by the implementation of two programs and the analysis of the factors that are influencing individuals’ intentions to use them.

3. Purpose of the study

The purpose of this study was to examine students’ preferences to use two programs, Google Drive Spreadsheet and Arquimedes, to elaborate budgets and measurements for building projects. In addition, based on the work of Davis, Bagozzi and Warshaw [14], this work aimed to explore the extent to which certain variables (perceived ease of use, perceived usefulness, output quality, and enjoyment) have an impact on students’ intentions to use those applications, as well as to determine the effect of these variables among each other. Davis, Bagozzi and Warshaw [14] found that perceived usefulness and enjoyment had an impact on usage intentions which, in turn, had an effect on the real use of computers. Moreover, perceived usefulness and enjoyment were influenced by output quality and perceived ease of use (see Fig. 2). Since our study was carried out with graduate students, it focuses only on students’ intentions to utilize Google Drive Spreadsheet and Arquimedes, but not on the impact of usage intentions on the actual use of these applications in their professional life. A longitudinal research should be conducted to collect data about the latter variable.

According to the purpose of our study, the following research questions emerged:

Question 1. Which application, Google Drive Spreadsheet or Arquimedes, do students prefer to elaborate budgets and measurements for building projects in their academic and professional lives? For what reasons do students choose one application or the other?

Question 2. How well do perceived usefulness, enjoyment, output quality and perceived ease of use predict students’ intentions to use Google Drive Spreadsheet for budgeting and measurement in building projects?

2.1. How much variance in usage intentions scores can be explained by the four independent variables?

2.2. Which variable is the best predictor of students’ intentions to use Google Drive Spreadsheet?

2.3. What is the effect of perceived usefulness, enjoyment, output quality and perceived ease of use among each other? Do any of these variables work as mediators in stu-
4. Method

4.1 Participants

The sample consisted of all the students \((N = 92)\) at a southeastern Spanish university enrolled in the course Economic management: measurements, budgets, and property valuations during the school year 2014–2015. This course is offered in the third year of the Building Engineering degree. Of the 92 respondents, a total of 57 were male (62%) and 35 were female (38%). Their age ranged between 20 and 39 \((M = 23.8, DT = 3.4)\). Most of the students (95.7%, \(n = 88\)) were taking the course for the first time, and 31.5% \((n = 29)\) of the participants combined work and study. Only one participant out of the 29 working students, had a job related to the subject. Finally, most of the students that combined study and work had part-time jobs (89.7%), with 34.5% \((n = 10)\) working up to 10 hours per week, 41.5% \((n = 12)\) devoting from 11 to 20 hours to work and 13.8% \((n = 4)\) working between 21 and 30 hours per week.

4.2 Instrumentation

The questionnaire used in this study consisted of three parts. The first part sought to collect socio-demographic data. The items of the second part, the main section of the instrument, were drawn from the original scale developed by Davis, Bagozzi and Warshaw [14]. This scale comprised five dimensions: (a) perceived usefulness (4 items), (b) enjoyment (3 items), (c) perceived ease of use (4 items), (d) perceived output quality (3 items), and (e) usage intentions (2 items). All items were measured using a five-point Likert scale (1 = strongly disagree; 2 = disagree; 3 = undecided; 4 = agree; 5 = strongly agree). Participants had to complete the second part of the questionnaire twice: once for Google Drive Spreadsheet and again for Arquimedes. The third part of the instrument comprised two questions which sought to collect information about the students’ preferences for using one software application or the other (Arquimedes and Google Drive Spreadsheet) for academic and professional purposes. Both questions included statements such as: “I am more skilled in it”, “I feel more confident”; “It is more comprehensive”, “The final result looks more professional”, etc.

According to Kurpius and Stafford [33], the instrument showed a good internal consistency with alpha coefficients above 0.80 in all dimensions. Total scale reliability was 0.92 for both Google Drive Spreadsheet and Arquimedes subscales. These results are consistent with the original scale reliability reported by Davis, Bagozzi and Warshaw [14].

4.3 Procedure

Research was conducted with all the students enrolled in the course Economic management: measurements, budgets, and property valuations that is given during the third year of the Building Engineering degree at a public university in Spain. The complete course consisted of 87 hours distributed in 29 sessions of three face-to-face hours each. Twenty-five out of the 29 sessions were dedicated to explain the process of budgeting and measurement for different kinds of building projects. Classes were mainly practical, where students, working in small groups, had to do the exercises proposed by the teacher. Apart from the sessions, students could watch explanatory videos about the subject contents. Teacher interventions were confined to short lesson introductions and specific clarifications.

During the course, participant students used and evaluated two tools to elaborate budgets: Google Drive Spreadsheet and Arquimedes. Google Drive is a file storage and synchronization service that allows users to store files in the cloud, share files, and edit documents. One of the major advantages of working with Google Drive is that users can edit the same document at once. For this study, we have used Google Drive Spreadsheet. On the other hand, Arquimedes [34] is a specific software application for project management. In this case, it was used the student version of the program. Both applications were employed to prepare measurement and budget activities proposed by the teacher.

From the beginning of the course students used
the Google Drive Spreadsheet to do the exercises, devoting to this activity 19 sessions of three hours each (57 hours). Each group of students worked online with this service, having the advantage of editing the same document simultaneously. Besides, the spreadsheets were shared with the teacher. After these sessions, when students had already consolidated the basic knowledge about budgeting, the Arquimedes software was introduced. Students dedicated six sessions to this program and a total of 18 hours. Unlike Google Drive Spreadsheet, the Arquimedes software does not allow students to work simultaneously online.

Students completed the first part of the questionnaire regarding Google Drive Spreadsheet before using Arquimedes. Likewise, they responded to the second part of the instrument about the Arquimedes software by the end of the course.

5. Results

Descriptive analyses and standard multiple regressions were performed to assess students' preferences for using Google Drive Spreadsheet and Arquimedes, as well as to explore the ability of perceived usefulness, output quality, enjoyment and perceived ease of use to predict students' intentions to employ both programs. Preliminary analyses were conducted to ensure no violation of the assumptions of normality, linearity, multicollinearity and homoscedasticity. Results are displayed according to the research questions proposed.

5.1 Students' preferences for using Google Drive Spreadsheet and Arquimedes

When students were asked which system they would prefer to use in academic and professional contexts, 57.1% (n = 52) of them stated that they would use Google Drive Spreadsheet for academic purposes, while 40.7% (n = 37) preferred Arquimedes. However, 71.7% (n = 64) of the students considered Arquimedes a better application for professional purposes and only 23.3% (n = 21) would use Google Drive Spreadsheet in their professional life.

Table 1 shows the reasons for which students prefer one application or the other in academic and professional contexts. Overall, among the students who chose Google Drive Spreadsheet for academic purposes instead of Arquimedes, 80.8% stated that they would use this system because they were more skilled in it and considered this tool to be good for working collaboratively (82.7%). They also thought that Google Drive Spreadsheet was easier to use than Arquimedes (61.5%) and let users customize the product (53.8%). In contrast, 79.7% of the students would choose Arquimedes for professional purposes because it is more comprehensive than Google Drive Spreadsheet for budgeting and measurement, it has better features (75%), and the final output has a more professional appearance (64.1%). Finally, students thought that Arquimedes would be good for work because it does not need to be connected to the Internet (54.7%).

5.2 Students' intentions to use Google Drive Spreadsheet

Table 2 displays means, standard deviations, and the correlations between the variables. Significant relationships were found between the criterion (usage intentions) and the predictor variables: perceived usefulness ($r = 0.730, p < 0.001$), output quality ($r = 0.720, p < 0.001$), enjoyment ($r = 0.639, p < 0.001$), and perceived ease of use ($r = 0.20, p < 0.05$). All these relationships suggest that the more useful, enjoyable, and easier students perceive the use of Google Drive Spreadsheet, as well as its output quality, the more they intend to use it.

The $R^2$ value of 0.669 (see Table 3) indicates that the total variance explained by the model as a whole was 66.9%, $F (4, 87) = 44.004, p < 0.001$. However, although the correlations between all the predictor

<table>
<thead>
<tr>
<th>Academic context</th>
<th>Professional context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Google Drive Spreadsheet</td>
<td>Arquimedes</td>
</tr>
<tr>
<td>n = 52 (57.10%)</td>
<td>n = 64 (71.10%)</td>
</tr>
</tbody>
</table>

Table 1. Students' preferences for using Google Drive Spreadsheet and Arquimedes in academic and professional contexts

<table>
<thead>
<tr>
<th>Preference</th>
<th>Academic context</th>
<th>Professional context</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am more skilled in it</td>
<td>80.8</td>
<td>4.7</td>
</tr>
<tr>
<td>I feel more confident</td>
<td>46.2</td>
<td>12.5</td>
</tr>
<tr>
<td>It is more comprehensive</td>
<td>5.8</td>
<td>79.7</td>
</tr>
<tr>
<td>It has better features</td>
<td>5.8</td>
<td>75.0</td>
</tr>
<tr>
<td>The final result looks more professional</td>
<td>5.8</td>
<td>64.1</td>
</tr>
<tr>
<td>It allows to work collaboratively with more users.</td>
<td>82.7</td>
<td>0</td>
</tr>
<tr>
<td>It is easier to use</td>
<td>61.5</td>
<td>18.8</td>
</tr>
<tr>
<td>It is more intuitive</td>
<td>32.7</td>
<td>12.5</td>
</tr>
<tr>
<td>It allows me to customize it</td>
<td>53.8</td>
<td>4.7</td>
</tr>
<tr>
<td>It allows me to adapt it to my needs</td>
<td>30.8</td>
<td>21.9</td>
</tr>
<tr>
<td>It does not need an Internet connexion</td>
<td>0</td>
<td>54.7</td>
</tr>
</tbody>
</table>
variables and the criterion were statistically significant, only perceived usefulness ($t_{87} = 3.653, p < 0.001$) and output quality ($t_{87} = 5.218, p = 0.001$) contributed significantly to regression, with the output quality variable recording a higher beta value ($\beta = 0.419, p < 0.001$) than the perceived usefulness variable ($\beta = 0.351, p < 0.001$).

According to these results, further analyses were conducted to determine to what extent enjoyment and perceived ease of use are mediated by perceived usefulness and output quality. Table 4 summarizes the main findings. The predictor variable perceived ease of use did not show any statistically significant relationship with either perceived usefulness ($r = 0.167, p > 0.05$) or output quality ($r = 0.048, p > 0.05$). However, the relationships between enjoyment and the criteria perceived usefulness ($r = 0.712, p < 0.001$) and output quality ($r = 0.539, p < 0.001$) were significant. The multiple regression for perceived usefulness showed a $R^2$ value of 0.509, $F(2, 89) = 46.050, p < 0.001$, with only enjoyment having significant effects on perceived usefulness ($t_{89} = 9.328, p < 0.001$). When output quality was brought into the equation the whole model explained 58.9% of the variance [$F(3, 88) = 42.065, p < 0.001$] in perceived usefulness. The variable output quality only explained an additional 8.1% but with significant effects on perceived usefulness ($t_{88} = 4.155, p < 0.001$). The regression analyses for output quality also showed that only enjoyment had significant effects ($t_{89} = 6.067, p < 0.001$) on that variable. In this case, the whole model explained 29.4% of the variance in output quality [$F(2, 89) = 18.547, p < 0.001$]. Results of final research model can be seen in Fig. 3.

### Table 2. Means, standard deviations, and correlations for students’ usage intentions of Google Drive Spreadsheet and predictor variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usage intentions</td>
<td>7.27</td>
<td>1.91</td>
<td>0.730**</td>
<td>0.720**</td>
<td>0.639**</td>
<td>0.200*</td>
</tr>
<tr>
<td>Predictor variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Perceived usefulness</td>
<td>14.52</td>
<td>3.28</td>
<td>–</td>
<td>0.621**</td>
<td>0.712**</td>
<td>0.167</td>
</tr>
<tr>
<td>2. Output quality</td>
<td>10.61</td>
<td>2.51</td>
<td>–</td>
<td>–</td>
<td>0.539**</td>
<td>0.048</td>
</tr>
<tr>
<td>3. Enjoyment</td>
<td>10.13</td>
<td>2.74</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>0.191*</td>
</tr>
<tr>
<td>4. Perceived ease of use</td>
<td>16.82</td>
<td>2.31</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

*p < 0.05, **p < 0.001.

### Table 3. Regression analysis summary for perceived usefulness, output quality, enjoyment, and perceived ease of use predicting students’ usage intentions of Google Drive Spreadsheet

<table>
<thead>
<tr>
<th>Variable</th>
<th>$B$</th>
<th>SE $B$</th>
<th>$\beta$</th>
<th>$t$</th>
<th>$p$</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived usefulness</td>
<td>0.204</td>
<td>0.056</td>
<td>0.351</td>
<td>3.653</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Output quality</td>
<td>0.318</td>
<td>0.061</td>
<td>0.419</td>
<td>5.218</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Enjoyment</td>
<td>0.101</td>
<td>0.063</td>
<td>0.145</td>
<td>1.613</td>
<td>0.110</td>
<td></td>
</tr>
<tr>
<td>Perceived ease of use</td>
<td>0.077</td>
<td>0.052</td>
<td>0.094</td>
<td>1.485</td>
<td>0.141</td>
<td></td>
</tr>
</tbody>
</table>

Note: $R^2 = 0.669 (N = 92, p < 0.001)$.

5.3 Students' intentions to use Arquimedes

Findings show significant relationships between the criterion (usage intentions) and all the predictor variables, as well as significant relationships between the predictors (Table 5). Overall, the size and direction of the correlations suggest that the more useful, enjoyable, and easier students perceive the use of the Arquimedes software, the more they

### Table 4. Regression analyses summary for enjoyment, perceived ease of use, and output quality predicting perceived usefulness and output quality of Google Drive Spreadsheet

<table>
<thead>
<tr>
<th>Variable</th>
<th>$B$</th>
<th>SE $B$</th>
<th>$\beta$</th>
<th>$t$</th>
<th>$p$</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived usefulness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predictor variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enjoyment</td>
<td>0.623</td>
<td>0.099</td>
<td>0.520</td>
<td>6.286</td>
<td>0.000</td>
<td>0.589*</td>
</tr>
<tr>
<td>Perceived ease of use</td>
<td>0.074</td>
<td>0.099</td>
<td>0.052</td>
<td>0.747</td>
<td>0.457</td>
<td></td>
</tr>
<tr>
<td>Output quality</td>
<td>0.441</td>
<td>0.106</td>
<td>0.338</td>
<td>4.155</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Perceived usefulness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predictor variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enjoyment</td>
<td>0.505</td>
<td>0.083</td>
<td>0.550</td>
<td>6.067</td>
<td>0.000</td>
<td>0.294*</td>
</tr>
<tr>
<td>Perceived ease of use</td>
<td>−0.062</td>
<td>0.099</td>
<td>−0.057</td>
<td>−0.630</td>
<td>0.530</td>
<td></td>
</tr>
</tbody>
</table>

*p < 0.001.
intend to use it. Likewise, the higher the students perceive the output quality, the more they intend to use the application.

The standard multiple regression conducted to assess the ability of perceived usefulness, output quality, enjoyment, and perceived ease of use to predict students’ intentions to use the Arquimedes software reported a $R^2$ value of 0.671, $F(4, 87) = 44.300, p < 0.001$ (Table 6). Altogether, 67.1% of the variability in students’ usage intentions of the Arquimedes software was predicted by the four variables introduced in the equation, with the variable perceived ease of use recording a higher beta value ($\beta = 0.330, p < 0.001$), followed by enjoyment ($\beta = 0.318, p < 0.001$), perceived usefulness ($\beta = 0.245, p < 0.01$), and output quality ($\beta = 0.185, p < 0.05$).

Finally, additional regression analyses were conducted to determine the extent to which perceived usefulness, output quality, enjoyment, and perceived ease of use may have a significant effect among each other. Only significant effects were found on perceived usefulness [$R^2 = 0.464, F(3, 88) = 25.374, p < 0.001$]. In this case, enjoyment and perceived ease of use were non-significant ($t_{88} = 1.868, p > 0.05$; $t_{88} = 1.809, p > 0.05$, respectively) and only output quality had a significant effect on perceived usefulness ($t_{88} = 5.860, p < 0.001$, $\beta = 0.512$). Fig. 4 displays the final model according to these results.

![Fig. 3. Multiple regression model illustrating the relationships among enjoyment, perceived ease of use, perceived usefulness, output quality and intentions to use Google Drive Spreadsheet.](image)

![Fig. 4. Multiple regression model illustrating the relationships among enjoyment, perceived ease of use, perceived usefulness, output quality and intentions to use Arquimedes software.](image)
6. Discussion

The main purpose of this study was to examine students’ preferences to use two different software tools to elaborate budgets and measurements for building projects (Google Drive Spreadsheet and Arquimedes) and determine the extent to which certain variables (perceived ease of use, perceived usefulness, output quality, and enjoyment) have an impact on students’ intentions to use them.

Findings indicate that students prefer Google Drive Spreadsheet in the academic context and Arquimedes for professional purposes. Reasons such as ease of use, skills, features or professional appearance of the programs arose. Results also show that people’s intentions to use Google Drive Spreadsheet are influenced by their perception of how useful this application is and how they perceive the output quality of using Google Drive Spreadsheet, Output quality was the strongest predictor, having influence on usage intentions by itself and by its effect on perceived usefulness. These results are partly congruent with previous studies, since Davis, Bagozzi and Warshaw [14] found that perceived usefulness affect usage intentions of a system. Nevertheless, in that study, perceived usefulness and enjoyment mediated the effect of output quality on usage intentions. Our results also show that enjoyment has significant effects on both perceived usefulness and output quality. We have detected that perceived ease of use has no effect on either usefulness or output quality. This result is not consistent with other studies, which show that perceived ease of use actually has an effect on perceived usefulness [6, 11, 19], and also on enjoyment [14]. This discrepancy with previous research might be due to the fact that Google Drive Spreadsheet is very intuitive and easy to use, especially when individuals have experience in spreadsheets. In our study, the majority of the participants had previous experience in using spreadsheets, being 3.2 the average value of students experience (meaning 1 no experience and 5 large experience). Moreover, 61.5% of the students preferred the Google Drive Spreadsheet for academic purposes due to the ease of utilization of this application. This result suggests that the variable perceived ease of use may not be a good predictor when individuals consider the software application very easy to utilize. However, further research should be conducted to obtain more conclusive evidence.

With regard to Arquimedes, it was found that all the variables (perceived usefulness, output quality, enjoyment and perceived ease of use) have influence on usage intentions. Perceived ease of use was the strongest predictor, in contrast with Google Drive Spreadsheet, in which perceived ease of use had no effect on usage intentions. These results suggest that perceived ease of use may be an influential variable only when the program has certain degree of complexity. In fact, when students were asked the reasons for which they preferred using one of the two applications, many of them (61.5% in academic contexts and 61.9% in professional contexts) chose Google Drive Spreadsheet because it is easier to use. However, only a small number of students (21.6% in academic contexts and 18.8% in professional contexts) chose Arquimedes because of the ease of use.

Finally, the variable output quality not only has a direct effect on usage intentions, but also an indirect influence on them through its effect on perceived usefulness. This relation was also found in the study carried out with Google Drive Spreadsheet. This finding is partly congruent with the study of Davis, Bagozzi and Warshaw [14], that also found an influence of output quality on perceived usefulness, but not a direct effect on usage intentions. Furthermore, the present study showed significant effects of the variable enjoyment on usage intentions, which was also found in previous research [7, 14].

Despite the methodological rigour of the study, some limitations should be taken into account and, when possible, addressed. First, the study was conducted with students from a particular university and engineering degree and, therefore, their responses may not reflect those from other students. Future research should include a wider sample with students from different degrees and geographical areas to supply more external validity. Second, the research is based on self-reported data and, thus, responses may be biased. Third, the cross-sectional nature of the study only provides information about students’ preferences and perceptions at a specific moment. However, these perceptions may change over time. Further longitudinal studies should be conducted to examine how individuals’ perceptions and the relationships among variables evolve. These kinds of investigations would also allow to study the actual use of a specific technology during their professional practice as proposed by Davis, Bagozzi and Warshaw [14]. Finally, due to lesson planning, students received more training on Google Drive Spreadsheet than on Arquimedes. In order to obtain more accurate results, future research should include a more equal distribution of training sessions for each program.

In this study, it was assumed that the two applications utilized can be used to do budgets with professional purposes. In the Arquimedes case this assumption is true, indeed it is a specialized program to elaborate budgets and measurements used by professionals and companies in the building sector. However, Google Drive Spreadsheet only partially meet the assumption because it is a general...
purpose software and must be customized to get a professional-looking budget. Hence, this study could be improved utilizing two specialized programs in order to know whether the results are consistent.

7. Conclusions

A successful technology implementation is a challenge for teachers in higher education. Understanding the key determinants of technology adoption could benefit teachers who want to overcome this challenge. With this purpose, this study examined the effect of the variables perceived ease of use, perceived usefulness, output quality, and enjoyment on students’ intentions to use a technology. Findings show that perceived usefulness, output quality and usage intentions correlate the same way in both Google Drive Spreadsheet and Arquimedes. These results suggest that students intend to use a specific technology when they think it is useful for their academic and professional purposes and also when the quality of the final product is good.

The variables ease of use and output quality correlate with the rest of the variables in different ways depending on the application used. More investigation should be carried out to obtain steady results. Findings also showed that when participants perceive the software application as very easy to utilize, the variable perceived ease of use has no statistically significant effect on usage intentions. These results suggest that technology acceptance models (e.g., TAM) should reconsider the inclusion of perceived ease of use as a predictor when the application is seen as very easy to employ, since it might have no influence on usage intentions.

Overall, this study provides awareness and understanding to technology acceptance theory. This knowledge will be helpful for those attempting to design or implement successful systems, especially teachers willing to have a satisfactory outcome when they implement a specific software tool in their classes. Besides, our findings showed that students prefer Arquimedes more than Google Drive Spreadsheets to elaborate budgets and measurements for building projects in the professional context. Therefore, in order to achieve effective and meaningful learning experiences, teachers should include in their classes those specific programs that are known to be more useful for students’ future professional practice.

References


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