Analogue and digital access to architectural information

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Abstract. Access to architectural information has undergone great changes due to the global use of the internet. In the digital environment, the quantity of information and its "free" availability create advantages compared to the high costs of editing and publishing books and magazines. This fact has resulted in a tendency to simplify the content with striking images and avoid information from texts that emphasise the philosophy of the project. Previous research indicates that both digital and analogical sources are complementary, but there is no examination of whether the search behaviours or the types of architectural information influence students' results. This research aims to observe the digital and analogue access habits of architecture students and to delve into the reasons for these behaviours. A questionnaire on access to architectural information has been designed and validated, in which 170 undergraduate students from the School of Architecture of the Universidade da Coruña have participated. The results show that younger students focus on image-based social networks as a source of information, despite acknowledging that higher-quality information can be found in analogue sources such as books and magazines. Furthermore, it has been detected that information search habits influence student results, depending on the nature of the subject.

Keywords: architecture; arts; design projects; libraries; communication; digital information; information science; students; library use; information seeking behaviour.

1 Introduction

The globalisation of the Internet has resulted in significant changes to the storage and accessing of information. These changes have been especially pronounced in the case of architecture, since this discipline normally requires graphic means to communicate complex information.

Libraries have been essential in training architects, whose needs are even unclear for professionals who analyse their use of information [1]. Architecture students essentially seek out national and international projects to use as a reference for the type of project they are doing in their core subject of Design Project/Studio.

This common phenomenon among architecture and design students is known as "analogical reasoning" or the "design-by-analogy method" [2–4] in which the selection of the source is very important since it can influence the success of the problem solving [5, 6]. This method is also used by professionals [2].

An architecture project normally begins with preliminary research, something that has traditionally involved a visit to the library [7]. In arts courses, where it is common to look for references and inspiration, architecture students do not carry out a systematic search and instead randomly leaf through the available publications [1, 8, 9], which implies the need for physical access to the shelves for on-shelf browsing [9]. This procedure is very different to that seen in other libraries, where users simply request specific books and the staff find them.

Libraries in architecture schools provide specialised monographs and magazines that have undergone very careful editing, provide plenty of visual information, are limited edition and therefore are expensive. So, it is common for them to need large budgets to purchase the bibliography and pay the expensive regular subscriptions, and even to access the current e-versions of journals.

However, in recent years, student visits and loans of books or magazines have been gradually declining. Although purchases and subscriptions have continued at the same rate as in previous years, centres are beginning to assess whether it is essential to maintain them or whether it is possible to reduce the budget, especially in times of economic crisis. In fact, previous research at Universidad de Sevilla has provided marketing proposals to communicate with users who no longer go to the library either physically or virtually [10].

This situation suggests the need to look in more depth at how architecture students access information and to find out whether this influences their studies.

2 Background

2.1 Sources of information in architecture

Architectural information sources include analogue (or traditional) and digital ones. The first relates to printed books and magazines. The second covers all digital content such as websites and blogs (i.e., Archdaily, Deezen, Designboom, etc.), image-based social networks (i.e., Pinterest, Instagram, etc.), video hosting websites (i.e., YouTube, Vimeo, etc.) and audio distribution systems called podcasts, which have experienced exponential growth in recent years or decades.

The traditional dissemination of leading architectural projects has a similar format in monographic books and magazines, which have undergone very little change over more than a century. It consists of a series of printed pages that include enough plans to define a building, as well as a set of photographs and introductory texts by the architect or publisher. More complementary documentation may also appear such as plans of construction details, sketches, photographs of secondary areas or details and texts by architecture critics or other architects (see Fig 1.). In any case, the information is mainly visual and accepted as essential to understand and analyse an

architectural project in depth. In fact, unlike students from other disciplines, art and design students are referred to as visual and kinaesthetic learners who receive information in a predominantly visual way with images from books and screens [11].

Digital architectural information is usually much more limited. The websites dedicated to architecture significantly simplify the information. The authors of blogs or specialised websites are highly selective about the information they provide. In general, these sources provide fewer descriptive plans, insufficient to define the building, but present a greater abundance of "shocking" photographs or renders (see Fig. 1). They rarely provide constructive details and, as a result of taking into account visual fatigue, the continuous changing of pages and a certain dispersion of attention, they provide many fewer texts, avoiding any in-depth explanation of the architectural work.

Fig. 1.. Left pic: magazine example that combines different graphical representation and text. Right pic: website example based on shocking photographs.

2.2 Architecture information-seeking behaviour

Training to be an architect and working as an architect both require constant and interactive access to sources of information [12] both on technical matters and design solutions. For this reason, information is considered a critical element for architects to perform their tasks [13], and essential for the decision-making process [14].

However, previous studies have focused on the needs of architecture firms, who require information, generally technical, to solve immediate problems and need quick solutions [14]. In the 1970s, a senior member of a medium or large firm (20-200 people) would have received architectural information by post. After cataloguing and accumulating this technical information they would have decided whether or not to share it with other colleagues [15]. However, in general architects relied on past experience to solve problems using personal collections and only seeking information when a significant new problem arose [16].

Travelling and drawing is a direct way to get closer to architectural information. The first of these has been considered an essential complement in the training of architects, culminating in the travel notebooks of great masters of architecture such as Le Corbusier, Alvar Aalto and Louis Kahn [17]. Architecture schools often include,

among their annual activities, academic trips to introduce their students to the architecture of another country, a specific architect, etc. This also fosters the habit of architects going on their own trips as a method to understand the structure of a city and its architecture.

At the same time, in situ sketching of buildings and landscapes has been considered ideal to extract the essence of the architecture. This is something that great architects have recognised in their writings when referring to their training or influences.

The architects in these investigations did not seem to consider having personal libraries as a source of information. However, Elliot [18] discovered that observing and discussing images with peers was key when beginning a project. The architects indicated that they did not use the web to acquire images because it was time consuming and they did not know where to look for what they needed, a digital deficiency that has been reported in more recent studies on graphic designers [19, 20].

Makri and Warwick [21] looked at the information needs of students taking a master's in architecture, specifically how they search, interpret and use the information to design their projects. They reported that students were not interested in searching for exact results, but were trying to find things that would inspire them without direct links to the task at hand, as well as using non-architectural sources or collections of favourite images from professional architecture firms [22]. This procedure, which was more intuitive than systematic [1], brings together references that can be, among others, cultural, technical, personal, sociological or geographical.

Considering that architecture is a technical and artistic profession, it is interesting to observe this type of phenomenon. Students of art or design (including architecture) seek two types of knowledge: technical information and visual references for their inspiration [23].

In this paradigm shift, students do not perceive library research as relevant to their projects [24]. They are particularly interested in elements that encourage observation through accidental discovery [21]. However, Lo and Chu [1] found that art and design students continued to use print materials and physical libraries, which they complemented with internet and social media resources. Thus, Campbell [25] analysed information-seeking behaviours in members of an architecture faculty. The results indicated that internet sources and books were the most important, also providing a vision of the parallel use of printed and digital materials.

The search for references in architecture includes everything from literal examples of images or visual solutions to more free ones in which the structure of the project, its concept or some partial detail is transferred. In the best cases, the student achieves a reinterpretation of the concept or even the creation of a new one. These cases can be so abstract that the source is hard to recognise since the student has applied a mental process to generate the new project instead of applying the same solution.

Advanced students have reported less obvious goals that result in more successful structural analogies [4], which may correlate with the type of documents they are looking for or with their search habits. In fact, novice designers benefit more from more specific sources of inspiration [26]. Furthermore, it has been shown that architecture students can develop this design by analogy ability, moving from literal similarity to analogical similarity [27].

2.3 Objective

This research is designed to analyse the current trends in information-seeking behaviours by architecture students, both analogue and digital, and the reasons for these, as well as to find out if these habits influence their architecture training and whether they are related to the age of the student.

For this, it is necessary to consider the relationship students have with the library in their education centre and their perception of how libraries in architecture schools should look in the future to adapt to new trends and opportunities for information searches.

3 Methodology

A quasi-experimental exploratory study of a mixed nature (mainly quantitative) has been carried out using a survey as the data collection method. The research has been carried out at the Escuela Técnica Superior de Arquitectura (ETSA), the School of Architecture at the Universidade da Coruña (Spain), founded in 1975. Despite its medium size, its library is one of the most important in the country, with a high ratio of volumes per student (see Table 1).

Table 1. Most important architecture school libraries in Spain ordered by volumes per student ratio.

University	School	Year of foundation	# students	Volumes	Journal subscriptions	Area (m2)	volumes/ student
UDC	ETSA A Coruña	1975	847	62491*	491*	900*	73.78
UPC	ETSA Vallés	1973	900	41197*	64*	534*	45.77
UPM	ETSA Madrid	1844	2698	113080*	1391*	2342*	41.91
UPC	ETSA Barcelona	1875	1772	71885*	1464*	2255*	40.57
US	ETSA Sevilla	1960	1629	64965*	775*	859*	39.88
UPV	ETSA Valencia	1968	1756	19264*	60*	700*	10.97

*Data provided by the library staff in each architecture school.

The survey was performed in the second week of the COVID-19 lockdown (March 2020), a situation when students had first-hand experience of not being able to access analogue sources. The survey had already been planned, but coincided with this situation, which was especially interesting because students had no access to analogue sources for the first time in their lives, so they could better assess the differences in access to both types of sources.

The Access to Architectural Information Questionnaire had already been prepared (AAIQ). The AAIQ was prepared in Microsoft Forms and sent to all ETSA

Architecture Degree students by email. All students taking the degree in architecture studies (847 students) were invited to participate in the AAIQ and they were given an explanation of the intention behind the study. Once the period for completing the survey had ended, analyses were performed to validate the use of the tool, and consequently its data for statistical work.

A description of the sample was produced through the analysis of the mean of each variable. A variance test was then performed to understand whether architectural information habits depend on age. Next, multiple linear regression analyses were performed in order to identify whether architectural information habits can be explained by other variables in the AAIQ. Likewise, a comparison was made of the means of the frequency of use of information sources and the perception of their importance. Finally, a qualitative analysis using categorical data was conducted regarding an open question included in the survey on contributions to improve access to architectural information. Traditional qualitative data analysis was conducted by using deductive and inductive processes through a meaning-centred analysis approach: content analysis, coding, grouping data and interpretation of the meaning. To this end, all answers were carefully examined and consequently four themes were created: analogue vs. digital information, need and usefulness of training and support, implications in teaching and proposals for application.

3.1 Sample

In Spain, architectural courses combine artistic and technical knowledge, even training students in structural calculations that allows them to take legal responsibility for the structures of their buildings. This implies that it is a long course and therefore that students are in a higher age range than in other countries. In fact, the final project takes one or more years, since students must demonstrate their comprehensive mastery of each of the artistic and technical skills.

The AAIQ was completed by 170 students. The answers are reasonably balanced between students in the various years of the bachelor degree. In terms of digital background, age should be a factor, which is why age groupings have been made (see more details in Table 2).

Table 2. Sample distribution in age groups.

	Age groups (in years)			
	18-20	21-23	24-26	>27
Number of students	42	57	42	29

3.2 Access to the Architectural Information Questionnaire

The AAIQ is divided into five scales (see Table 3): frequency of access to information, direct contact with architecture, the importance of the type of information, search purpose, and usefulness of the information according to the

source. These are Likert type 7-point scales, in which students must give a number between 1 and 7 to express how they feel about a particular statement.

Table 3. AAIQ scale structure.

Factor	Items
Frequency of access to information	8
Direct contact with architecture	4
Importance of the type of information	7
Search purpose	3
Usefulness of the information according to the source	5

3.3 Specific factors in the research

Architecture training outcomes: subjects in Spain. In order to identify how these habits influence student performance, the Grade Point Average of three subjects has been used:

- Design project: a core subject in which students elaborate their project. This subject is taken every semester of each course, so students have been asked for their latest GPA, since it will be the one that best reflects their current information-seeking habits.
- Architectural analysis: this course involves descriptive, site, functional and technological analysis through graphic techniques; which means a training focused on design by analogy capacities.
- Architectural shape analysis: freehand drawing course that seeks to understand and represent architectural shapes and encourage drawing as a project creation and design tool.

Fig. 2.. Architecture in A Coruña and its surroundings. (a) Centro Gallego de Arte Contemporáneo by Álvaro Siza. (b) Facultad de Fisioterapia by Manuel de las Casas. (c) Domus by Arata Isozaki. (d) Casa de Corrubedo by David Chipperfield. (e) Museo de Bellas Artes da Coruña by Manuel Gallego. (f) Tower of Hércules.

Architecture in A Coruña. One of the specific factors that will be taken into account in the research is direct contact with architecture, which includes students' involvement in their environment or when they travel. Despite the medium size of the city of A Coruña (about 250,000 inhabitants), it is a 2,000-year-old city with a valuable and varied historical heritage. Regarding contemporary architecture, in this city and nearby, there are works by Spanish and foreign architects of interest, winners of national and international awards such as Siza, Isozaki, Chipperfield, Gallego or De la Sota, including the Tower of Hércules (originally built by the Romans in the 2nd century BC), a lighthouse declared a World Heritage Site (see Figure 2), in addition to many more works by lesser-known architects. This information is important since it is connected with one of the questions 'Visit relevant architectural buildings in your city'.

4 Results

4.1 AAIQ reliability and validity

To explore the structure of the AAIQ, reliability was analysed using Cronbach's alpha, obtaining a result greater than 0.70 (Alpha = 0.837) which indicates a high level of internal consistency. Likewise, the KMO and Bartlett tests have been carried out to apply Exploratory Factor Analysis and consequently validate the measurement of the data to explore the structure of the construct. Bartlett's sphericity was significant (Chi-square (351) =1547.023, p <.001) and KMO is greater than 0.7 (KMO=0.712), which implies that it is possible to make a comparison between the magnitudes of the observed correlation coefficients and partial correlation coefficients.

Exploratory Factor Analysis, using the principal component and orthogonal rotation (Varimax) extraction method, has resulted in a seven-factor structure that explains 58.765% of access to information in architecture: direct contact with architecture (#1), types of information (#2), digital sources (#3), traditional searching behaviour (#4), traditional sources (#5) digital searching behaviour (#6) and search purpose (#7).

4.2 Descriptive analyses

First, descriptive analyses of the sample have been carried out to explain the behaviour of the sample. Regarding the frequency of access to information (see Table 4), four groups can be considered by proximity to the values 2, 3.5, 4.5 and 6. Podcasts are at the lowest value, followed in the second group by using the library for work and reading books. In the next group are magazine queries, library visits, YouTube viewing and information search on blogs. While the use of image-based networks stands out with a rating close to 6.

Table 4. Frequency of access to information.

Item	Mean	Deviation
Visit the library of the school of architecture	4.36	1.571
Use the library of the school of architecture for work	3.35	1.989
Read architecture books	3.70	1.546
Read specialized architecture magazines	4.14	1.782
Search for architecture information on blogs	4.81	1.547
Watch architecture content on YouTube	4.38	1.843
Browse architecture content on image-based networks	5.98	1.534
Listen to architecture podcasts	2.15	1.539

When students' contact with architecture is reviewed (see Table 5), we find that drawing receives a score below half the maximum score in both cases. However, visiting buildings varies greatly depending on whether the students are in their city or travelling, obtaining a much higher value in the latter case. These results indicate that students do not value the architecture in their own environment despite its recognised importance.

Table 5. Direct contact with architecture.

Item	Mean	Deviation
Visit relevant architectural buildings in your city	4.24	1.742
Visit relevant architectural buildings when travelling	6.05	1.249
Draw places or buildings in your city	3.06	1.682
Draw places or buildings when you travel	2.89	1.975

Regarding the type of information students look for (see Table 6), they rate plans, elevations and sections as the most valued (m = 6.37), followed by axonometric, perspectives and renders (m = 5.88), photographs (m = 5.53), graphic analysis and diagrams (m = 5.53), construction details (m = 5.22) and author's comments on the work (m = 5.19). Finally, descriptive texts are the worst rated (m = 4.65). The low interest in authors' comments and descriptive texts seems to indicate that students have an interest in the descriptive features of the architectural reference rather than the philosophy (or concepts) and reasons behind the project.

Table 6. Importance of types of architectural information.

Item	Mean	Deviation
Elevations, plans and sections	6.37	0.922
Axonometric, perspectives and renders	5.88	1.171
Photographs	5.53	1.452
Descriptive texts	4.65	1.603
Graphical analyses, diagrams, etc.	5.41	1.486
Constructive details	5.22	1.530
Author's comments on the work	5.19	1.689

In relation to the purpose of the information search (see Table 7), the search for references for projects is given a higher value than the objectives of representation and analysis of buildings.

Table 7. Purpose of the information search.

Item	Mean	Deviation
Find references to develop your project	6.14	1.237
Learn other styles of graphic representation	5.64	1.340
Graphically analyse a building	5.01	1.582

Finally, regarding the usefulness of information according to the source of origin (see Table 8), students consider books to be the best source for finding information, closely followed by magazines (values close to 6). For their part, blogs obtain almost one point less (m = 5.05), and image-based networks and YouTube are almost two points below the highest ranked (m = 4.38 and m = 4.14).

Table 8. Usefulness of the information according to the source.

Item	Mean	Deviation
Architecture books	5.99	1.182
Specialised magazines in architecture	5.81	1.337
Blogs	5.05	1.475
YouTube	1.14	1.697
Image-based networks	4.38	1.706

4.3 Variance analyses

One of the premises of the study was that access to information habits depend on the age of the student, due to generational changes and rapid technological advances. An ANOVA analysis of variance has been performed to check if this is true and whether it is statistically significant. The results indicate that most of the information access habits depend on the age of the student, specifically the following variables (see Table 9): visiting the library (p <0.001), using the library to work (p = 0.027), consulting specialised magazines (p <0.001), watching architecture content on YouTube (p = 0.056) and viewing architecture content on networks based on images (p = 0.009). These results seem consistent since the younger the students are, the more familiar they are with technologies and digital access to information.

Subsequently, the means by age group of each variable have been examined to look further at how the values behave according to the groups that have been shown to have statistically significant differences (see Table 10). These data have been obtained through the application of the Tukey test. The results indicate that for visiting the library, working in the library and looking for information in architectural magazines, the value increases with age, by more than 1.8 points in the greatest difference. However, the viewing of architectural content on YouTube and image-based social networks decreases with age. The technological changes over this decade

are so rapid that differences can be observed between an 18-year-old student and a 28-year-old student, with those aged 18 being even "more digital".

Table 9. ANOVA results.

Item		Sum of squares	df	Root mean square	F	Sig.
Visit the library of the school of architecture	Inter-groups	53.465	3	17.822	8.135	<0.001
	Intra-groups	363.646	166	2.191		
	Total	417.112	169			
Use the library of the school of architecture for work	Inter-groups	36.001	3	12.000	3.148	0.027
	Intra-groups	632.822	166	3.812		
	Total	668.824	169			
Read architecture books	Inter-groups	3.237	3	1.079	0.447	0.720
	Intra-groups	400.463	166	2.412		
	Total	403.700	169			
Read specialised architecture magazines	Inter-groups	57.093	3	1.031	6.588	<0.001
	Intra-groups	479.519	166	2.889		
	Total	536.612	169			
Search for architecture information on blogs	Inter-groups	7.088	3	2.363	0.987	0.401
	Intra-groups	397.506	166	2.395		
	Total	404.594	169			
Watch architecture content on YouTube	Inter-groups	25.492	3	8.497	2.572	0.056
	Intra-groups	548.413	166	3.304		
	Total	573.906	169			
Browse architecture content on image-based networks	Inter-groups	26.664	3	8.888	3.974	0.009
	Intra-groups	371.242	166	2.236		
	Total	397.906	169			
Listen to architecture podcasts	Inter-groups	5.361	3	1.787	0.752	0.523
	Intra-groups	394.662	166	2.377		
	Total	400.024	169			

Table 10. Average frequency of access to information by age group.

	Age groups (in years old)			
	18-21	22-24	25-27	>27
Visit the library of the school of architecture	3.6	4.18	4.83	5.14
Use the library of the school of architecture for work	2.57	3.47	3.69	3.74
Read specialised architecture magazines	3.31	4.09	4.4	5.07
Watch architecture content on YouTube	4.93	4.37	4.29	3.72
Browse architecture content on image-based networks	6.29	6.18	5.98	5.14

Figure 3 displays the distributions visually, showing a displacement of the younger age groups towards behaviour of searching for digital information.
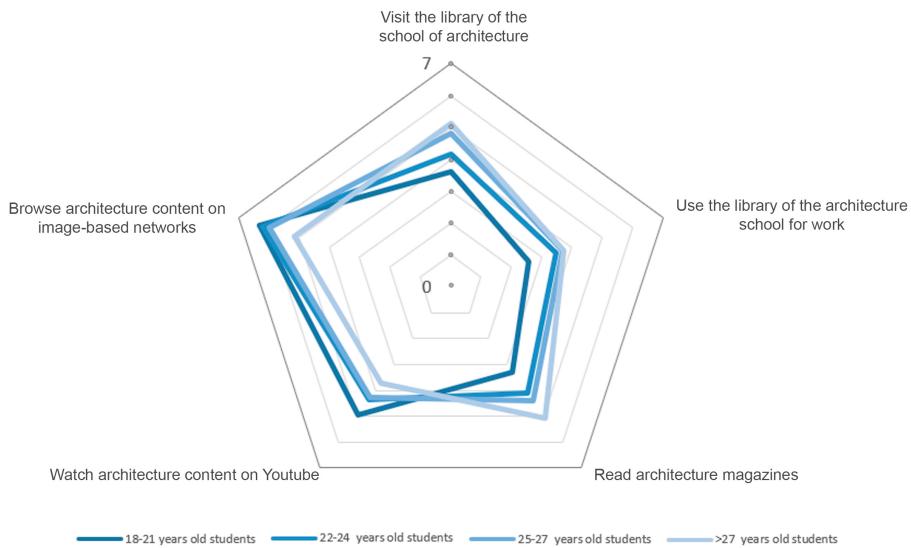
Fig. 3.. Frequency of access to information by age group.

4.4 Multiple linear regression

Next, multiple linear regression analyses have been performed on each of the information access habits to understand whether they can be explained by the rest of the AAIQ variables (see Table 12). Visiting the library (Model 1) can be 13.8% explained by the importance given to books and descriptive texts and the importance given to axonometric, perspectives and renderings. Reading architecture books is statistically significantly explained, at 30.5% (Model 2), by the extent to which students draw architectural buildings or places when they travel, the degree of usefulness of the information from architectural books, visiting relevant buildings in their city and the degree of usefulness of information from magazines and descriptive texts. Reading architecture magazines can be 28.7% explained (Model 3) by the perception of the importance of information from magazines, drawing places when travelling, the importance given to image-based social networks and the extent to which they seek to understand graphic styles to represent architecture. In the case of searching for information in blogs (Model 4), this is 14.6% explained by the variables of importance given to the information in blogs, knowing other styles of graphic representation and searching for references for their projects. The viewing of architectural content on YouTube is 32.9% explained (Model 5) by the importance they give to the content of this source, the degree to which they draw places or buildings in their environment, their perception of the importance of the information from magazines and the degree of searching for project references as information search purposes. For its part, the habit of viewing content on image-based networks is 27.2% (Model 6) explained by their perception of the importance of the content of this source, the extent to which they seek references to develop their project, visiting

architectural buildings when they travel and attaching importance to axonometric, perspectives and renders. Listening to architecture podcasts is 9.9% (Model 7) explained by the extent to which they visit buildings in their city and the purpose of seeking information for the graphic analysis of a building.

Table 11. Multiple linear regression results (dependent variables: information access habits).

| Model	R2	F	df1	df2	Sig.	Durbin-Watson
1	0.150	6.003	1	166	0.015	2.043
2	0.305	4.144	1	164	0.043	1.791
3	0.287	1.505	1	165	0.026	1.858
4	0.146	3.931	1	166	0.049	2.105
5	0.329	6.032	1	165	0.015	2.251
6	0.272	4.980	1	166	0.027	1.611
7	0.099	4.095	1	167	0.045	1.950

In addition, the predictive analysis of academic performance depending on the AAIQ variables has been performed (see Table 12). Project performance (Model 1) can be predicted 11.2% by the degree of reading specialised architectural magazines. Performance in Architectural Analysis (Model 2) can be predicted 12.9% by the degree of consultation of architectural magazines, visits to buildings when travelling and the perceived importance of the content of image-based networks. Performance in Architectural Shape Analysis (Model 3) is 4.7% explained by students drawing buildings when travelling.

Table 12. Multiple linear regression results (dependent variables: academic performance in architecture).

Model	R2	F	df1	df2	Sig.	Durbin-Watson
1	0.112	20.230	1	152	<0.001	2.174
2	0.129	4.169	1	114	0.043	1.785
3	0.047	8.464	1	149	0.004	1.962

4.5 Comparative analysis: use and perception of the importance of the information source

The descriptive values of the average frequency of use of a source have been compared with the perception of its importance among students. The results indicate a lack of consistency between what students consider important and the extent to which they access it (see Figure 4). While they regard books as the most important source and they have use of one of the best libraries in the country, this is the one they have accessed the least. Very similar results have been obtained for magazines as a source. In contrast, image-based networks are considered to be almost the least important source of architectural information but are the most widely accessed.
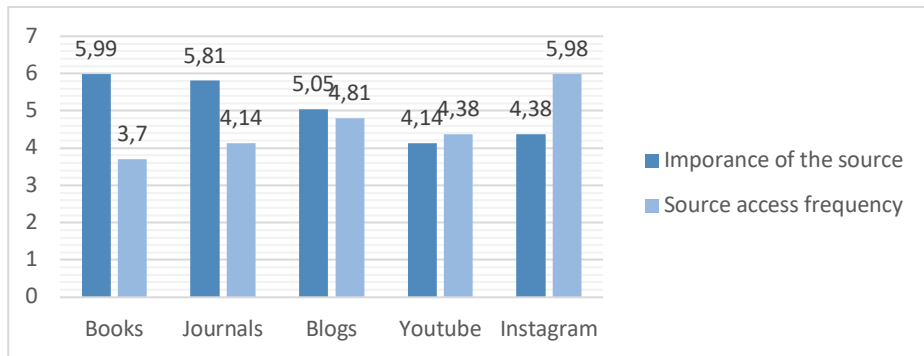
Fig. 4.. Comparative bar chart: perceived importance of a source vs frequency of accessing that source.

4.6 Qualitative analysis of student contributions on improving access to architectural information

Most of the students giving their opinions agree with the importance of the library in architectural training. The ideas drawn from the interviews have been divided into four categories: quality of analogue vs. digital information, need and usefulness of training and support, implications for teaching and proposals for application.

Almost half of the contributions indicate that one improvement would consist of digitising the existing sources. This idea identifies a library as a mere source of information, not somewhere for the exchange, creation or invention of knowledge. Likewise, there is a difference between the quality of information in the library and that found digitally, which is limited to photos and brief descriptions (student #105) and is labelled "fast consumption and shallow, since they are based on the number of visits instead of quality, possibly due to the difficulty of monetising this information on the internet" (student #45). Students are also aware that in addition to digital content trying to be more generic and not taking as in-depth a look at the work, more errors are found (student #60) and nobody ensures that the content is truthful or useful (student #137). In addition, student #70 adds that "online information and magazines are awkward to handle".

Students have recognised the usefulness of library staff (student #14) and indicate that they did not discover this until the final stage of their education: "until I started my final project, I did not understand how useful librarians are" (student #32). In this sense, they indicate that "the staff are always willing and eager to help us, but we do not always know how far we can go and often, especially among younger people, they don't dare to ask" (student #99). They are also aware of the need to be trained in how to search for information both in the library (student #65) and on the Internet (student #45), suggesting that, in the absence of this, they end up searching Google (student #39) or Pinterest (student #44). In fact, they suggest that this information may exist on the Internet, but they are not finding it when they search for it, instead doing so when they are flicking through a magazine or surfing the Internet (student #88).

Regarding the relationship between access to information and teaching, students request that the usefulness of accessing information be demonstrated as part of the teaching practice (student #32) or that search time in the library be promoted as part of the work. (student #54), as well as including reading and searching for references as tasks on the course (student #96), being aware that this habit fosters interest and learning (student #122). In addition, they propose promoting the use of the library by commenting on works in class (student #151), as well as the teachers themselves teaching how to look for such quality information, suggesting that the relationship between students and teachers should be one of trust, creating a pleasant environment allowing for the transmission of knowledge to everyone (student #76), indicating "that many teachers already do this by making you aware of websites, graphic authors or architects of their taste that they consider will help you" (student #137).

Finally, a series of proposals to be applied were collected to improve access to architectural information. First, some comments related to the inclusion of common databases of other types of material, such as blocks of computer programs for specialised elements such as slabs, metal profiles, saying "that it would save the student a lot of time by not having to search for those blocks or draw them" as well as "a background of plans and scanned plans of relevant architectures, something that the library currently lacks, as well as a collection of city plans with a definition suitable for their interpretation and analysis" (student #117). Second, there was a proposal for the weekly contribution of a couple of works to be analysed, allowing knowledge to be acquired in a more supervised way, since "the Internet is full of information and sometimes it is difficult to know how to filter it" (student #44). This could be added to with architecture books, blogs (students #96 and #126) or YouTube channels or podcasts to listen to while they work as "I feel that no matter how much I search, I do not know which sources might be better ... especially also based on our limited knowledge, there are so many, and so many forums where they are recommended, that, again, one does not know what to choose" (student #75). In addition, they mention the need to teach students how to contribute their information on the Internet (student #45), indicating that there is no repository of the projects created at the school, this only happening in a minority of cases.

5   Discussion

Access to architectural information is essential for both professional architects and those taking academic courses in this discipline. Most research related to information-seeking behaviours in architecture dates back to the 1980s when the world was analogue. This research has attempted to examine the information-seeking behaviour of architecture students and how it might affect their performance.

The results indicate that students regularly visit the library, but that they are less likely to use it as a place to consult sources. They see the library as a pleasant, quiet place to search for external information over the Internet, catch up on social networking, rest, wait for classes, etc. These findings are supported by the previous literature that reports that students do not perceive library research as relevant for their projects [24]. In this case, it has been verified that the students who go to the

library more frequently are those who consider books and descriptive texts to be of greater importance.

Regarding access to analogue sources, namely printed books and magazines, the results indicate a declining trend: the younger the students, the less they read. Although they consider magazines and books to be important for their training, they rarely use them. Differences in the use of these analogue sources can be been explained through the relationship with different variables. First, reading books has been related to a student's degree of direct contact with architecture (drawing and visiting architecture) and their perception of the importance of analogical sources of knowledge (books and magazines) and the usefulness of descriptive texts. Second, consulting magazines shares the dependence on the degree of direct contact with architecture (visit architecture) but differs in its dependence on the perception of the importance of architectural content in visual networks and whose search purpose focuses on graphic styles for representing architecture. These findings demonstrate a low demand for particular searches and in-depth knowledge, in line with the trends in literature towards accidental discovery [21].

However, information search habits in digital sources are greater for blogs and even more for image-based networks. The use of blogs is related to the search for project references and graphic representation styles, that is, a practical and functional approach to solving problems. However, image-based networks stand out notably, despite recognising that the usefulness of their content is less than that of analogue sources. This shows an evident interest in visual content in keeping with previous studies [11], which solves the problem of time-consuming digital search procedures that research indicated was an issue at the beginning of the digital age [18]. This is very convenient for accidental discovery purposes, but it seems to continue to be a problem when searching for a particular result [19], since being born in the digital age does not entail technological training [7]. Its use is directly related to their perception of the usefulness of this source of content, which is greater the younger the student is, as well as the extent to which they seek references for their projects and visit architecture. In addition, these findings are consistent with works that indicate that Internet queries are the most abundant [1].

The situation is not one of coexistence between digital and analogue sources, but a dependence on the immediacy of visual content available on the Internet instead of in-depth written knowledge, which supports previous findings [28]. The problem is that this visual consumption habit usually creates a barrier to accessing analogue information [29]. This research confirms that this trend is related to the student's age, a factor that demonstrates the generational technological leap. It has been shown that accessing analogue information increases with age, while consuming digital content is much greater in those who are younger. In the field of architecture, this oversimplification trivialises information, which favours the design by analogy process occurring at one of the most elementary levels, with a literal transposition of images or solutions instead of complex reasoning.

The research shows worrying trends in architecture students' use of information since they focus on biased and trivial information that does not provide in-depth knowledge about projects or allow for the development of complex design procedures by analogy. Furthermore, its relationship with academic performance demonstrates the need to combine various sources of information. Thus, performance in the Design

Projects course is directly related to the use of magazines, which also influences performance in the Architectural Analysis course, this also being related to visiting buildings when they travel and the perception of the usefulness of the content of image-based networks. Meanwhile, the Architectural Shape Analysis course is statistically significantly related to the extent to which a student draws when travelling. These findings fill the gap in the existing literature that indicates that students use digital and analogue sources in a complementary way [1][25] and they could be linking search habits with obtaining better design procedures by analogy [4].

Students talk about the importance of the library in their education, but they use digital sources more often. Libraries in architecture schools should be aware of how students structure their thinking, such as using random searches or flipping through images, and consequently transform information access support strategies that should not consist of a change from printed to digital sources. Students pointed out a key factor: they do not know how to search and nor do they know which sources are reliable or valid. So the training strategies for information search behaviours need to find a solution through providing content gradually, such as interesting architectural works, providing quality profiles from different digital sources (blogs, Instagram, YouTube, etc.) that they can add to their personal collection, creating reading groups to comment books and magazines of interest for students on different courses, etc.

The elaboration of the AAIQ has made it possible to gain a greater understanding about how and why architecture students access information, as well as the relationship between this and their performance in architecture. It is worth asking when and how these changes in the training of architects will affect the built architecture. Or whether in contrast, it is a turning point for improving the complementarity of use of digital and analogue sources to promote the most complete training for architecture students.

It is impossible to know how these changes will impact the built architecture due to their recent character and the fact that these "digital" students will still need a few years or decades before they are building their projects. However, there is no doubt that changes will occur.

5 Conclusions

The research demonstrates that great changes are taking place in the information demanded by architecture students, which, far from being a change from an analogue to a digital platform, entails differences in the information being accessed. The growing trend for accessing visual, incomplete and biased information is very strong, so must be treated with caution as it profoundly modifies the design procedure by analogy from the assimilation and reinterpretation of valuable references towards simplification and consequently has an impact on the training of architects.

The coexistence of digital and analogue sources is a potential tool that has never existed before and it is essential to develop strategies to take advantage of the benefits of this combination, since the performance in different architectural courses are correlated with specific search habits, sources or types of information.

Libraries in schools of architecture have fulfilled an essential function for centuries in the search for architectural references to develop student projects. However, it has been shown that many of the students who regularly use libraries actually do so to look at content on the web. We need to understand the new opportunities for generating habits that can be nurtured by academic and library staff through their analogue experience and knowledge of the validity of digital information.

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