

Non-Obvious Connections Between Information Literacy and Online Payments

Ivana Bestvina Bukvić

University of Josip Juraj Strossmayer of Osijek, Faculty of
Economics in Osijek

Ivana Đurđević Babić

Josip Juraj Strossmayer University of Osijek, Faculty of Education in
Osijek

Abstract: The importance of information literacy in today's digital world is increasingly emphasized. This is particularly evident in the context of using digital financial services. This article aims to investigate whether there is a relationship between information literacy and online payment preferences among a student population and whether there are gender differences in online payment habits. An online survey was conducted among students in Osijek examining information literacy and the types of goods they purchase and pay for through online financial services. Of the 408 respondents, the majority were female (86.27%), who were more likely to buy and pay for clothing, while men were most likely to make payments for particular features of video games. Differences were also found in the tendency to make online payments. Because no obvious linear relationships were found between reported information literacy and other variables, a neural network model with a multilayer perceptron (NN) architecture was developed to classify participants according to their reported information literacy level. The best overall classification accuracy of the NN was 73.17%. The NN and its sensitivity analysis revealed some hidden patterns that can help educational institutions develop information literacy and digital financial literacy programs for their students.

Keywords: information literacy, online shopping, online payments, gender, digital financial literacy

Introduction

The relationship between different types of literacy skills and online purchase intentions and digital payment preferences has been an important topic for some time. Werts (2008) highlighted information, visual, digital, and media literacy as key 21st century skills. These

skills are considered necessary to prepare the young population for the digital world ([Fraillon et al., 2020](#)). Information literacy is important because it is the ability to distinguish relevant from irrelevant information and data ([Head & Eisenberg, 2011](#)) in the digital environment, which includes extensive online financial activities and is necessary in daily life. Consequently, it has a positive impact on overall job performance ([Al-Azri et al., 2023](#); [Bruce, 1999](#)). Computer literacy or digital literacy is also highlighted in this context and often analysed in combination with information literacy ([López et al., 2022](#)). Eurostat, through the Digital Skills Indicator 2.0 (DSI), reports general digital skills composed of “information and data literacy skills, communication and collaboration skills, digital content creation skills, safety skills and problem-solving skills” ([Eurostat, 2022](#), n.p.), which are highest in Iceland, Norway, and Switzerland; and lowest in Romania, Bulgaria, and Poland. Furthermore, [Bannier et al. \(2019\)](#) are exploring bitcoin literacy in terms of gender differences, finding women’s literacy weaker than in the case of men. Therefore, further research on information literacy and its connection to various digital services is considered useful.

Although it appears that many young people are using digital technologies for their daily activities, including online shopping and digital payments, [Beheshti \(2012\)](#) emphasizes the need to develop their basic information literacy skills. This includes the issue of safety and risks that young people face in digital business activities. Unfortunately, the number of studies addressing the issue of linking information literacy and online activities with financial implications, such as online shopping, online payments, and various financial transactions, is limited. This shortage becomes even more emphasized if gender differences are considered. *The 2018 International Computer and Information Literacy Study* reports gender differences, with female students having higher scores in computer and information literacy than male students, while male students tend to have higher scores in computational thinking ([Fraillon et al., 2020](#)). Similarly, numerous studies report gender differences in online purchases and payments ([Kanwal et al., 2022](#); [Khaleeli, 2020](#); [Lin & Wang, 2020](#); [Lin et al., 2019](#); [Zhang, 2017](#); [Lin et al., 2017](#); [Nadeem et al., 2015](#); [Gayathiri et al., 2014](#); [Ruane & Wallace, 2013](#); [Chai et al., 2011](#)).

We argue that financial knowledge is not sufficient to enable young people to make decisions about online purchases and online payments in a safe manner, but that a broader level of information literacy is needed in today’s digital environment. The literature review found that there is relatively little published research on the relationship between information literacy and women’s online shopping and online payments. This problem exists even when gender differences are ignored, as many of the relevant papers were published nearly a decade ago while changes in digital environment are frequent. The importance of this issue is also underscored by the projections that digital payments and eCommerce will continue to grow

(from 2020, as a base year, to 2025, it is expected that digital commerce will grow in Europe by 16.3%, in the US by 15.20%, and in China 11.2% (Zavialova, 2021) and eCommerce from 2022, as a base year, to 2027 in Europe by 15.8%, in the US by 18.3%, and in China by 5.8% (Zavialova, 2022)).

To contribute to this field, we wanted to investigate whether there is a relationship between young people's level of information literacy and the types of goods they tend to buy and pay for online. We also wanted to compare these results with previous findings by other authors and verify whether neural networks can successfully classify individuals with high levels of self-assessed information literacy. Thus, the main goals of this work are:

- to determine respondents' self-assessed information literacy and their frequency of using online payments for various goods and services;
- to investigate whether there is a statistically significant relationship between information literacy and variables related to online payments;
- to attempt to develop a successful neural network model that classifies respondents according to their information literacy, based on general data and online payments.

For that purpose, we developed an MLP (multilayer perceptron) neural network using the hidden activation function tangent hyperbolic, sum of squares error, and Broyden-Fletcher-Goldfarb-Shanno (BFGS) algorithm. We also analysed the differences in the tendencies of the female and male student populations with respect to the different types of goods they purchased and paid for through online applications. The research was conducted at two Croatian social science faculties at the University of Josip Juraj Strossmayer in Osijek in the academic year 2021/2022. The sample consisted of 408 students, of which 86.27% were female respondents.

The rest of the paper is organised as follows. The literature review chapter introduces the publications relevant to the topic that address gender differences in online shopping behaviour and payment transactions, as well as the relationship between information literacy and shopping behaviour and payment transactions. The following chapters present the research methodology, research findings, and developed MLP neural network results. The last chapter contains a discussion and conclusion on the research results.

Literature Review

The literature review was conducted at two levels: 1) gender differences in online purchases and payments; 2) information literacy related to online purchases and payments.

Gender differences in online shopping and payments

For the purpose of literature search and analysis, the search query included WoS and Scopus and, at the following level, Google Scopus. At the first level, the keywords “gender”, “female”, and “women” were searched for in combination with the keywords “online payments” and “online shopping preferences”. At this level, as noted above, numerous works were found, most of which are emphasizing existence of gender differences in online purchases and payments. Kanwal *et al.* (2022) claim that women are less positive about online purchases and payments than men. Women’s decisions about online purchases and payments are also more influenced by privacy concerns and social influences (Kanwal *et al.*, 2022). This is consistent with the findings of Chai *et al.* (2011), who found that women have more privacy concerns than men, which may affect their propensity to share information on social networks or make online purchases and payments from online retailers. According to Zhang *et al.* (2017), women are more likely to shop at a wider range of retailers. However, this changes with household size. On the other hand, households with more working members are more likely to shop online, but from fewer retailers. Awan & Ho (2018) found a relationship between gender and online payments and online shopping intentions in an analysis of Chinese consumers, with women having lower online shopping intentions and being more aware of the risks of online payments and online purchases. This finding is consistent with Ravikumar & Prakash’s (2022) conclusions that women have less confidence in online payment services and tend to accept innovations gradually. Recent professional reports are also confirming that there are gender differences. Statista (2022) reports gender differences in online impulse purchases worldwide, with women most likely to buy clothing and footwear (57% of women vs 38% of men) and personal care products (29% of women vs 18% of men). On the other hand, men are most likely to impulsively buy electronics (49% vs 27% of women) and toys, games or books (44% vs 38% of women) online.

In contrast to previous findings, Nadeem *et al.* (2015) believe that gender differences are decreasing, as the authors found no significant difference in the intensity of e-trust, e-attitude, and e-loyalty between genders, although women’s attitudes toward online retailers are more influenced by online peer recommendations in social networks (Nadeem *et al.*, 2015). These findings are consistent with those of Sahu & Singh (2017), who found that gender did not influence the relationship between various constructs (facilitating conditions, hedonic motivation, value for money, and habit) and purchase and payment intention via a mobile platform for booking tickets in India. Raj & Singh (2016) developed a decision tree model with the objective of finding out how demographic characteristics (including gender, age, annual income, occupation, spending, etc.) influence the frequency of online purchases and developed a model with 66.45% accuracy. They found that of all the variables analysed, including gender

as an influencing factor, spending was the most important in predicting online purchase frequency.

Information literacy in connection to online shopping and payments

The literature search on information literacy in relation to online purchases and payments was also conducted on two levels by evaluating the Scopus and Web of Science databases with a combination of the keywords “information literacy” and “online payments” in the first search round. After filtering by relevant subject areas (excluding medicine, physics, and astronomy), the following results were found: Scopus 15 articles; and 11 in Web of Science. In WoS and Scopus, only one paper by Seldal & Nyhus ([2022](#)) was filtered out that contained keywords in combination with “women” or “gender” or “female” in this field of research. Because a detailed analysis of the search results revealed that the filtered results did not fully match the topic of this study, we set out to find articles that were closer to the topic of the relationship between information literacy and women’s online shopping and payment preferences in the Google Scholar database. Searching for the same keywords yielded approximately 17,700 results for articles published in the last 5 years (as of 2018), but, again, relevance was limited. Nevertheless, we have singled out and analysed the works that are thematically most similar to our research area.

Head & Eisenberg ([2011](#)) conducted a survey of 8,353 students from 25 US colleges (with more than 70% of respondents being female). Although most students searched the Internet for news and information about shopping, health, and wellness, they were found to have difficulty finding and filtering relevant from non-relevant information. Mahmood *et al.* ([2022](#)) analysed the current digital information literacy (DIL) of 269 female online shoppers in Pakistan and found that information literacy has a strong influence on women’s online shopping behaviour. Although their digital information literacy is at a good to moderate level, they rarely use advanced search techniques, are reluctant to use online payments, and generally infrequently use online purchasing ([Mahmood et al., 2022](#)).

Shang *et al.* ([2013](#)) studied the problem of information and alternative overload on online shopping websites and how it affects customers’ purchasing decisions. It seems that too many products offered in online stores reduce consumers’ subjective status regarding their purchase decision. Moreover, a longer time spent on online websites is not necessarily a positive thing, but a sign of the buyer’s indecision and a bad feeling about their choice. Therefore, they conclude that “information literacy will be essential for people in the information age” ([Shang et al., 2013](#), p. 641). The level of information literacy, according to Shirzadi *et al.* ([2022](#)) in their research conducted in Iran, does not influence customers’ decisions about the brand and

the time they spend in the online shop, but the size of the purchase (the number of garments purchased), the place of purchase, and the payment method do.

Leung (2009) analysed various aspects of information literacy: tool literacy, resource literacy, social structure literacy, research literacy and publishing literacy, new technologies, and critical literacy. The author found that Publishing Literates (people who are able to format and publish research and ideas in text and multimedia formats) are more likely to be female and tend to be very active users of various Internet applications, such as online shopping and online payments. Stephen (2022) studied financial literacy among a group of librarians and information scientists in northeast India and defined it as “a set of abilities and information that enables a person to make informed and effective financial decisions” (Stephen, 2022, p. 2), although it seems that the author placed financial literacy under the umbrella of information literacy as a broader field. At the same time, the author defined digital financial literacy as a combination of financial literacy and digital literacy that enables users to understand and use digital financial services. Ravikumar & Prakash (2022) studied the factors affecting the adoption of digital payment services among small bricks-and-mortar retailers in Bangalore, where digital literacy was also referred to as information literacy in the study. Perceived risk and digital illiteracy were found to be strongly related.

Considering all of the above, it is understandable why most researchers of online purchases and online payments narrow their scope of research and focus on financial literacy or digital literacy rather than the broader more comprehensive concept of information literacy.

Research Results

The study was conducted in the academic year 2021/2022. A total of 408 students from the Faculty of Education and the Faculty of Economics responded to the call for participation in this study. All participants gave their informed consent to participate in this study before accessing the study and completing the online questionnaire, which recorded participants' general data (5 variables), self-rated information literacy (1 variable), and frequency of using online payments for various purposes (12 variables).

The majority of participants were female (86.27%), slightly less than three-fifths (59.56%) of them were from the Faculty of Economics, less than half of them (47.79%) were between 18 and 21 years old, three-eighths of them (37.50%) were in their second year of study, and the same number of them lived in a rented private apartment or room. Most participants (84.60%) had made online payments for purchased goods and services in the 12 months prior to the survey. According to the survey, there was a lower level of receptivity to digital payments among women compared to men. Almost a quarter of the women (24.44%) who were asked about their likelihood of using online payments for purchases did not give a positive response,

whereas an overwhelming majority of men (94.6%) showed a positive inclination towards this option.

More than half of the participants (52.45%) self-rated their information literacy as very good, slightly more than one-ninth (11.27%) as excellent, and less than one-third (31.86%) as good. Only 3.92% reported having adequate information literacy and 0.49% reported having inadequate information literacy.

When it comes to using online payments for various purposes, as seen in Figure 1, between two-fifths and seven-ninths (depending on the online payment purpose) said they mostly do not use them at all, with the exception of ordering clothes. Just over one-seventh (14.46%) of them do not use online payment when ordering clothes and 7.35% almost never use it.

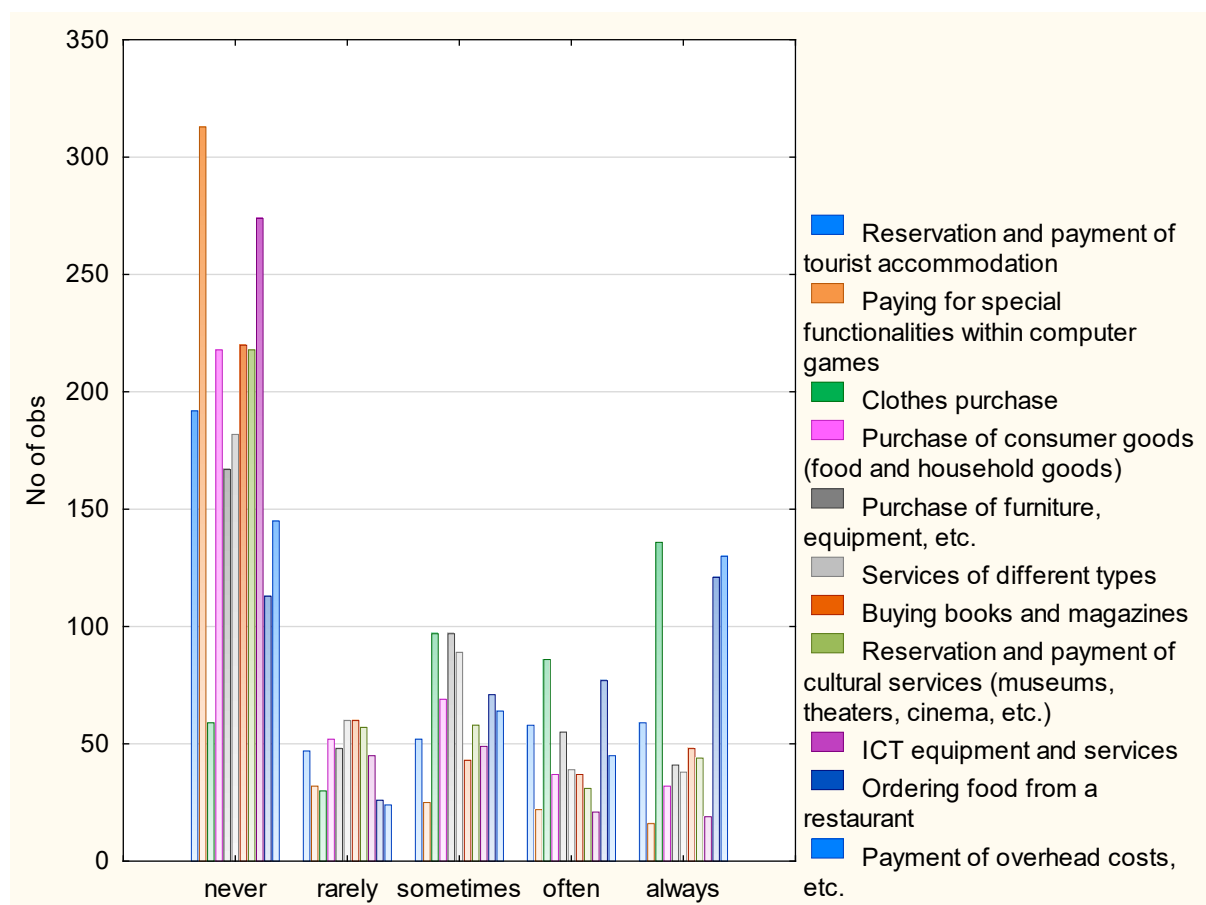


Figure 1. Frequency of online payment use for various purposes

To determine whether there was a relationship between reported information literacy and other variables, the chi-square test (χ^2 test) was used. At a significance level of 0.05%, no statistically significant relationships were found between variables.

Since no obvious linear relationships were found, a neural network model was created to classify participants according to their reported information literacy level. For this purpose, participants were divided into two categories. Those who indicated a high level of information

literacy (excellent or very good) were placed in category 1 (63.81%) and the others in category 2 (36.19%). The total sample was then divided into a training (70%), a testing (20%), and a validation (10%) subsample. A multilayer perceptron (MLP) neural network architecture was used, and 200 different models were trained, tested, and validated, modifying various architectural elements. The best overall classification accuracy of 73.17% on the validation subsample was obtained with the MLP neural network that used the hidden activation function hyperbolic tangent, the sum of squares as error function, and the Broyden-Fletcher-Goldfarb-Shanno (BFGS) algorithm. This model had higher accuracy in identifying students with higher information literacy (80.77%) than the other category (60%).

When analysing which variables had the greatest impact on this model, sensitivity analysis revealed that the descriptive variables used had the greatest impact – accommodation while studying (1.89), gender (1.45), year of study (1.32), and age (1.25) – while among the variables for the purpose of online payment, payment for specific functionalities within video games (1.17) had the greatest impact.

Because neural networks were used as a nonlinear method to classify participants and the questionnaire was used solely for data collection, no internal consistency was calculated.

Conclusions and Recommendations

Based on a literature review, it was found that there is a gap in research on interconnection of information literacy and the use of online financial services by the young population. This becomes even more evident when the gender perspective is taken into account. On the other hand, it was found that the development of information literacy is particularly important in many areas of life and especially in the use of digital financial services. According to the results of this study, most of young people used online payments in the past 12 months (84.6%) and most often for buying and paying for clothes, which is particularly pronounced in the female group, and for buying and paying for special features in video games, which is most common in the male student group. Most participants do not use online payments for other various purposes. In addition, females are less likely to make online payments, which is consistent with Kanwal *et al.* (2022), Chai *et al.* (2011), Awan & Ho (2018), and Ravikumar & Prakash (2022).

We found no obvious linear associations among reported information literacy and other analysed variables, but the neural network model managed to find some data patterns from which it was possible to successfully classify students with an overall classification accuracy of 73.17%. According to the results, accommodation, gender, year of study, and age had the greatest influence on the model.

These results may be useful for online sellers to identify their potential customer group. On the other hand, educational institutions can use the results of this study to understand the relationship between self-assessed information literacy and the use of digital financial services. This is because, despite the high self-assessment of respondents in terms of information literacy, there is clearly still a need for action in this area by expanding the content of study programs, as almost a quarter of respondents are not ready to use online payments, which can now be considered a basic financial service and convenience. Therefore, educational institutions should evaluate the level of information literacy among students and develop programs to improve it, focusing on its application in the digital environment. In this endeavour, educational institutions could develop targeted educational programs that address students' specific information and digital literacy needs, based on the hidden patterns revealed by the neural network model. There is also an opportunity to develop digital finance programs aimed at developing digital financial literacy, such as lifelong learning programs targeting student groups. One of the goals of these activities could be to address the gender gap in adoption of new types of digital financial services. By developing such programs based on neural network results, higher education institutions could improve student readiness for the digital age, and this is an area where their potential is of great importance.

There are a few limitations of this study which should be considered in interpretation of the results. The sample size was relatively limited and focused on a female population. To improve the generalizability of the results for both genders, a survey with a more balanced male-to-female ratio should be conducted in the future. Furthermore, the study relied on self-reported information literacy levels and online payment preferences from participants, which may introduce some bias in the results. As well, the limitations of the study are the geographical coverage and the number of variables related to the objective assessment of information literacy and online payments, since the self-assessment method was used in this research. It is important to acknowledge these limitations when interpreting the research results and to interpret the findings with caution.

In relation to the above, future research should increase the sample with more balanced male-to-female ratio, improve geographic coverage of the study, include a larger number of variables related to a more objective assessment of information literacy as well as the use of online payment services. As well, it would be useful to analyse whether there are differences that could be used to examine the existence of a relationship between general information literacy and digital information literacy on users' attitudes toward online payments. As well, in future research, researchers could use some of the already developed instruments for measuring information literacy, as well as other more objective measures for determining the use of online payments.

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