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Ewa Duda

Maria Grzegorzewska University, eduda@aps.edu.pl

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Exploring perceptions of pro-environmental educational mobile applications based on semantic field analysis

Completed Research Full Paper

Ewa Duda

Maria Grzegorzewska University
eduda@aps.edu.pl

Abstract

The paper aims to identify multidimensional perceptions of mobile apps by their users. Special attention has been paid to pro-environmental educational apps. Semantic field analysis and measurement of emotional temperatures were performed to achieve this goal. Transcripts from seven focus group interviews were used as research material. The results indicate that functionality based on a reward or benefit system reinforces environmentally friendly behavior. However, the reward system does not have to be based only on individual financial aspects, it can concern environmental actions, but it must nevertheless be measurable and noticeable. The findings also suggest that users place a high value on the app's utilitarian features and that respondents perceive aspects of the activities related to user behavior monitoring negatively. The novelty of the research stems from the methodology adopted. Research findings are significant from the point of view of both the developers of modern apps and the educators who could use them in the teaching-learning process.

Keywords

Educational mobile applications, Environmental education, Environmental literacy, Digital competences, Semantic field analysis, Users perceptions.

Introduction

Information Systems (IS) and their computerization have developed rapidly in recent decades. What was a novelty only a few years ago and required an intensive learning process for users is a matter of course for the next generation and has been with them almost since birth (Hirschheim and Klein, 2012). One manifestation of the development of IS is the increasing number of mobile applications present in the digital space, which, on the one hand, facilitates functioning in the modern world (Afreen, 2021), but, unfortunately, also increases digital exclusion and limits access to services or resources (Hargittai et al., 2019). The inevitable ubiquity of mobile applications is affecting more and more aspects of our lives, from social communication, entertainment, and education, to shopping, transport, healthcare, or agriculture (Nieradka, 2016). Therefore, with the development of mobile applications and their increasing presence in people's lives, a better understanding of social phenomena is essential.

How users perceive mobile applications may explain why some apps are very popular with them while others are used within a narrow range of functionality or by a small audience (Stocchi et al., 2018). Research to date has primarily focused on the most popular apps, such as educational apps, especially for language learning (Irudayasamy et al., 2021.), dedicated mobile commerce (McLean et al., 2020), healthcare (Chan and Honey, 2022) or physical activity promotion (Matthews et al., 2016). Far fewer address the perception of pro-environmental apps, i.e., those aimed at shaping environmentally friendly behavior (Duda et al., 2022). Given the importance and timeliness of the subject and the immediate need for effective educational tools to address the climate crisis, the motivation for undertaking this research



was to fill an identified gap in the literature for a deeper understanding of how urban residents perceive mobile apps, and in particular pro-environmental educational apps.

I believe that a non-standard methodological approach for user experience studies can provide a deeper understanding of the issue. Therefore, I used semantic field analysis in the current study. This method is most typically used in linguistics and makes it possible to decode the different meanings of a word depending on the context in which it is used. "The semantic field reflects the social patterns of the community. It is made of basic keywords, which command an army of others. The semantic area may be regarded as a network of hundreds of associations, each word of which is capable of being the center of a web of associations radiating in all directions" (Mackey, 1965, p.76). The adoption of semantic field analysis in the study of how users perceive mobile environmental applications represents an extension and deepening of existing knowledge with a new socio-cognitive aspect that will not only allow for a better design of applications tailored to the needs of future users but also facilitate the planning of educational interventions based on modern technologies, aimed at developing digital competences and improving the environmental literacy (McBride et al., 2013) of contemporary society.

Given the above reasons, the main objective of the research was to identify the multidimensional perceptions of mobile apps by their users, with a particular focus on pro-environmental educational applications, by urban residents depending on their environmental beliefs or professional status. To achieve the planned objective, I conducted a semantic field analysis guided by the following research questions:

RQ1: How do the positive-emotional semantic field networks reveal city dwellers' perceptions of mobile educational applications?

RQ2: How do the negative-emotional semantic field networks reveal city dwellers' perceptions of mobile educational applications?

RQ3: How do the neutral-emotional semantic field networks reveal city dwellers' perceptions of mobile educational applications?

In the following section, I give a brief outline of the theoretical background of the article. The next section presents the methodological framework of the study. An analysis of the research material collected is provided in the results section. I then discuss the findings in the context of other research that has been carried out using an alternative methodology for user experience studies. A conclusion section ends the article.

Related Works

The investigation of how users perceive products is gaining increasing interest among contemporary information systems researchers, focusing on a variety of aspects such as value perception (Kujala and Väänänen-Vainio-Mattila, 2009), privacy (Ayalon and Toch, 2019), or information sensitivity (Schomakers et al., 2019). Among these studies, the ones devoted to mobile applications for educational purposes are particularly prominent. The literature shows that many of these studies used qualitative methods based on coding and categorizing the content of the gathered research material. Indeed, Barboza and Filho (2019) conducted a content analysis of fora and social networks on websites dedicated to two selected community mobile apps. Their results indicated the presence of values such as hedonistic (pleasure from using the app), utilitarian (valuable functionalities of the app, such as the ability to reduce bills), social (a sense of prestige in a group of other users), egoistic (selfish, individualistic, looking at the benefits to the user) and biospheric (supporting pro-environmental behavior), which drove the use of apps supporting green consumption.

Al-Shamaileh and Sutcliffe (2023) conducted a mixed methods study to determine the factors influencing the decision to adopt a particular app. They asked 30 respondents to complete a questionnaire to determine which mobile apps were most frequently used and which were most frequently abandoned. Then, based on an analysis of the individual interviews, they employed a coding and categorization technique to identify the factors relevant to choosing a particular app. These were utility, effectiveness, and efficiency, but also aesthetics and hedonics. The least important factor was found to be rationality. A mixed approach was also used in a study on students' perceptions of apps as a tool to support environmental education (Senan and Nair, 2016). Based on a questionnaire with both multiple-choice and



open-ended questions, the authors analyzed the effectiveness and perception of the PEERA app, which functionality was based on a crowdsourcing mechanism. According to the results, students perceived the functionality positively. Students reported increased motivation and engagement in their learning through the app's implementation.

Another approach was presented by D'Arco and Marino (2021). To determine whether sustainability apps moderate the effect between pro-environmental behavior and personal norms, they conducted a quantitative study of more than 500 respondents living in the United States. D'Arco and Marino's research confirmed that people who use sustainability apps are more likely to take environmental action, prioritizing it over their norms. Motivation for environmentally friendly behavior can also be successfully reinforced with application-based persuasion systems, as shown in a quantitative study by Shevchuk and Oinas-Kukkonen (2019). Green Information Systems are, therefore, able to respond to current problems which require immediate action to protect the environment.

Methods

Procedure

Qualitative data collected through two-stage focus group interviews (FGI) were the basis of the analysis performed in this study. Interviews were conducted in seven focus groups based on a standardized scenario containing questions and issues related to environmental protection, pro-environmental behavior, and mobile applications. Discussions were held among purposively selected participants, moderated by a suitably prepared researcher. The first four interviews were conducted on 25 and 26 November 2021, followed by three more on 14 and 15 March 2022. Each interview lasted approximately two hours. The focus interviews were planned and coordinated by the Greencoin project team as part of WP2's work package task to conduct a user insight study. All interviews were conducted face to face by the selected subcontracted research institute.

Participants

A total of 56 participants took part in the interviews. Each of the seven interview groups consisted of four women and four men. These individuals were adult residents of the Polish Tricity (Gdańsk, Gdynia, or Sopot). The selection of respondents was based on a predetermined segmentation. Groups FG1 - FG4 were selected on the basis of their attitude (first stage of the research). Groups FG5 -FG7 were selected on the basis of their social roles (second research stage). The FGI1 and FGI4 groups represented moderately environmentally minded people, i.e., generally aware of ecological problems. However, they believe that there is still time to improve the situation of our planet and that no radical environmental measures are necessary for the time being. They were also not convinced that they should do anything about it. The FGI2 and FGI3 groups represented people with strongly pro-environmental views, i.e., with a high level of ecological problems awareness and environmentally destructive human activities. They believed that steps should be taken to protect the environment, and they demonstrated environmentally friendly behavior, such as separating waste and saving energy and water.

In the second stage, the selection was made based on the activity undertaken. FGI group 5 represented students at Tricity universities (the Gdańsk University of Technology, telecommunications faculty; University of Gdańsk, management and journalism faculty; Gdańsk Medical University, medical faculty. FGI group 6 represented office workers. This group included people employed in shipbuilding, events organization, data analysts, finance, and customer service specialists. FGI group 7 also represented office workers. However, this group included people employed in debt collection, human resources (HR), rail investment services, accounting and finance, data analytics, and customer service.

Data analysis

I analyzed and interpreted the statements of the interview participants using the semantic field analysis method (Robin, 1980). This method provides a deeper understanding of how mobile applications are perceived by their users or potential users. It concentrates on how respondents talk about these types of applications. Although this method is not widely applied, we can find many valuable analyses performed with this approach in the literature (Fatyga, 2015; Barankiewicz et al., 2021). It consists in selecting an



object of study represented by a word-key (in the current study, this word is 'application') and then analyzing the utterances containing this word (the so-called semantic field) due to their belonging to a selected network of meanings.

Robin (1980) distinguishes six such networks: (1) a network of equivalents, i.e., a set of words or expressions substituting or occurring interchangeably for the analyzed word-key; (2) a network of terms, i.e., a set of words or expressions describing, characterizing the analyzed word-key, most often answering the question "what?"; (3) a network of associations, i.e., a set of words or phrases that are associated with the analyzed word-key; (4) a network of oppositions, i.e., a set of words or phrases that convey information about what the analyzed word-key is not; (5) a network of entity actions, i.e., words or phrases that define actions or effects of actions taken by the analyzed word-key; and (6) a network of actions towards the entity, i.e., a set of words or phrases that define actions or effects of actions taken by others towards the analyzed word-key.

In the analysis, I also measured emotional temperatures (Fatyga, 2015), i.e., I assigned one of three temperatures to the individual semantic fields of the analyzed word-key 'application': (1) a positively-affected field; (2) a negatively-affected field or (3) a neutrally-affected field. The analysis was carried out using MAXQDA Analytics Pro software. The research material used for the analysis, in the form of interview transcriptions, was written in Polish (the language of the interviews). After the analysis, I translated selected phrases illustrating the results into English for this study.

Results

I initiated the analysis of the semantic field of the word-key "application" by depicting the statements of the research participants in the context of the emotional features of the individual networks of the field in question. In the research material, I extracted 207 semantic fields of the expression "application," which I classified into one of six networks and simultaneously one of three temperatures (18 possible choices). The distribution of the obtained semantic fields for each focus group is shown in Figure 1.

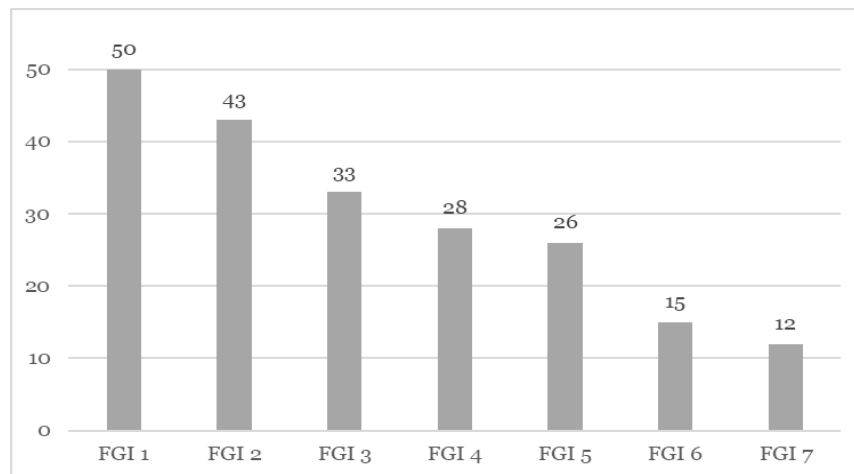


Figure 1. Distribution of semantic fields obtained for each focus group

The analysis of the frequencies for the individual networks (see Table 1) reveals a high degree of embedding of 'applications' in the interviewees' experience since the largest share of semantic fields is found in the category 'associations.' It covers 47.8% of all analyzed statements. The respondents do not construct their experience by putting the apps at the center of it. On the contrary, apps are seen as an additional tool for the design of their lifestyle.

		FGI 1 [%]	FGI 2 [%]	FGI 3 [%]	FGI 4 [%]	FGI 5 [%]	FGI 6 [%]	FGI 7 [%]
terms	positive	2.0	4.7	0.0	0.0	15.4	12.5	8.3
	negative	4.1	2.3	0.0	3.6	0.0	0.0	0.0
	neutral	2.0	2.3	3.0	3.6	0.0	0.0	0.0

associations	positive	14.3	11.6	9.1	7.1	7.7	25.0	8.3
	negative	12.2	7.0	12.1	35.7	0.0	0.0	8.3
	neutral	18.4	20.9	24.2	28.6	19.2	31.3	58.3
oppositions	positive	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	negative	2.0	0.0	3.0	0.0	0.0	0.0	0.0
	neutral	2.0	4.7	12.1	3.6	11.5	6.3	0.0
equivalents	positive	2.0	0.0	0.0	0.0	0.0	0.0	0.0
	negative	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	neutral	2.0	0.0	0.0	0.0	0.0	0.0	0.0
entity actions	positive	14.3	7.0	12.1	0.0	7.7	6.3	8.3
	negative	2.0	7.0	3.0	0.0	7.7	0.0	0.0
	neutral	8.2	7.0	3.0	3.6	19.2	0.0	8.3
actions towards entity	positive	8.2	9.3	9.1	3.6	0.0	0.0	0.0
	negative	2.0	2.3	6.1	7.1	0.0	0.0	0.0
	neutral	4.1	14.0	3.0	3.6	11.5	18.8	0.0
total		100	100	100	100	100	100	100

Table 1. Frequency analysis for each network

The lack of centralist tendencies toward the application is also reflected in the temperature distribution of the survey participants' statements (see Figure 2). Almost half of them had no clear emotional orientation. The presence of apps in respondents' everyday experiences is treated as natural and ordinary. However, negative emotions are also evident in one in five statements and positive emotions in one in three. Given this temperature distribution, I performed the rest of the analysis by applying it as a reference criterion.

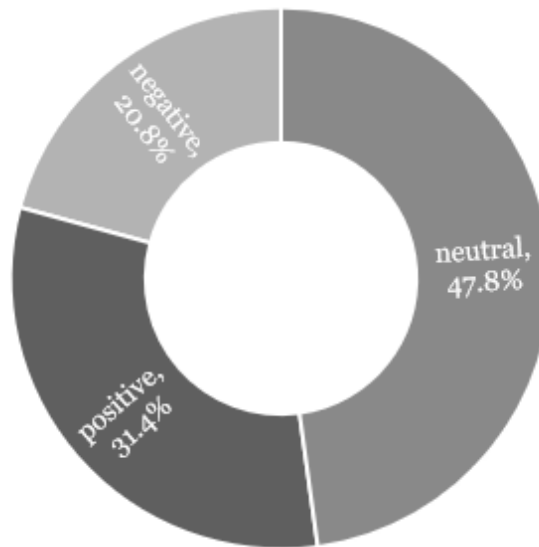


Figure 2. Distribution of emotional temperatures in the semantic field of the word "application".

Characteristics of neutral semantic fields

The 'associations' dominated among the networks with a neutral emotional temperature. This network comprised 51.5% of all the neutral semantic fields that emerged. The statements made by the interviewees were mainly those that evoked the experience of using a variety of available applications. For groups of

moderately ecological participants, these included weather apps or gamification apps used by their children. They also declared that some of their friends use pro-environmental apps (e.g., to measure air pollution, encourage cycling) but do not use them themselves. As an example, a participant said: *"I think we're spinning the kilometers now, aren't we? Gdańsk, Sopot, and so on, by bicycle. And there are prizes for that, too. I don't really use this app, because I don't have a bike"* (FGI 1: 498). In the opinion of this group, pro-environmental applications are not very popular in Tricity.

Participants in the group with a decidedly environmental view also declared knowledge of weather apps and consumer apps (grocery shops, industry) or apps dedicated to local residents. On the other hand, they identified many apps shaping environmentally friendly behavior, such as supporting using nutritional diets, reducing food waste, and encouraging physical activity. On the other hand, students declared familiarity with niche apps: *"I came across an app once; I believe it had something to do with either meditation or mindfulness"* (FGI 5: 324). Among office workers, an app was most commonly associated with a cooking app, a pedometer, or one supporting healthy eating.

The second network by frequency of occurrence was 'actions towards the subject,' containing 16.2% of all neutral semantic fields analyzed. This network comprised statements mainly concerning issues related to the installation of an app. Users declared that they decided to install an app most often based on its potential benefits. Among those with decidedly environmental views, opinions about not seeing such benefits were evident: *"I generally don't use. I don't feel any need to"* (FGI 2: 217), or considering their magnitude: *"I use this app [...], there are lots of other companies out there where you can collect points"* (FGI 2, Item 477).

Among those with moderate green views, some said it would be more beneficial for users if loyalty apps could be paired with cards so that their use did not require an internet connection. In contrast, statements from students indicated that, in addition to the potential benefits, a perceived issue for them was the app's popularity in question. According to them, attractive advertisements on Instagram and social media influence the decision to download and install apps.

In terms of frequency of occurrence, the following network was 'activities of the entity.' It covered 15.2% of all neutral semantic fields analyzed. In this network, respondents most often pointed to the functionalities and supporting role of the app. The notion that the app assists or supports the achievement of the chosen goals shone through in the neutral statements: *"I will throw the plastic bottle in the container, and the app will say bravo"* (FGI 1: 616). Functionalities that facilitate the realization of goals are confirmation of the completion of a task, providing information (e.g., air quality parameters), counting, and comparing.

The following network was 'oppositions.' It covered 12.1% of all neutral semantic fields analyzed. In this network, the statements of the interview participants indicated what the app is not supposed to be and what it is not supposed to do. Thus, phrases such as: *"The app is not supposed to convince you that you need to do something"* (FGI 1: 608) and *"She is probably not supposed to check"* (FGI 2: 675). One office worker expressed the idea that the app was not a cool, ordinary, unconvincing person. Several respondents' statements resonated that the app was not associated with a tool to support environmentally friendly behavior.

The penultimate network was 'terms.' This covered 4.0% of all neutral semantic fields analyzed. Within this network, four app terms were mentioned. These were: *"effective"* (FGI 1: 590), *"motivating"* (FGI 2: 695), a term relating to how the app works, *"not very encouraging"* (FGI 3: 854), *"giving as much as possible"* (FGI 4: 624) terms relating to the incentives used by the app. The last network with only one neutral statement regarding the app was 'equivalents.' The participant identified it with the program.

Characteristics of positive semantic fields

Among the networks with a positive emotional temperature, 'associations' also clearly dominated. This network comprised 36.9% of all positive semantic fields that emerged. Interviewees' statements referred to their experiences using the various applications, most often regarding the benefits they had gained. Comments about the potential benefits of using pro-environmental applications also resonated positively. Analysis of the individual semantic fields also shows no significant differences in the positive opinions of the representatives of the respective groups. Similarly, positive statements were made by representatives of the group with moderate ecological views: *"For example, there would be birdhouses for collecting bottles or something like that. I would support that. That would be cool. I don't have to get anything*

personally" (FGI 1: 530) as well as groups with strong ecological views: "It's not enough that we would save, that we would have smaller bills, they would also give us money for saving. Double" (FGI 2: 578).

For students and office workers, their positive associations with the keyword 'apps' are also related to the benefits experienced when using them. In the case of these groups, statements emphasizing social issues and group membership were more frequent. Participants in the interviews declared drawing inspiration from apps that are fashionable and used in their circle of friends, "Apart from the fact that you can check your progress, i.e., oh, I've got a gold medal, i.e., I've driven a given section the best in my history, and then you look at where there are friends still" (FGI 6: 296).

The second network by frequency of occurrence was 'entity's actions,' containing 27.7% of all positive semantic fields analyzed. This network consisted mainly of statements about the application functionalities, which the interviewees highly valued. Among them, such helpful solutions were mentioned as the possibility to identify the user by his or her phone number (no need to look for a code, to have constant access to the Internet), the creation of lists, rankings, statistics ("sometimes it is difficult to realize how many tons of plastic are used [...], a bottle here, a bottle there, a bag here, a bag there and so on. But as if you could through an app by scanning or something collect information and see at the end of the month how much we actually consume" (FGI 1: 625)), integration ("There are some apps that you have all your cards in one app" (FGI 3: 736)), a notification system ("And I remember that this app sent me interesting notifications, for example' your phone can rest too" (FGI 5: 324); "The banking app and there reminders practically every month, they motivate me a lot, that I get up in the morning, I go out to this job and I go and I smile" (FGI 6: 280)).

Another network was 'actions towards the entity.' This covered 18.5% of all the positive semantic fields analyzed. In this network, the statements of the interview participants were mainly about the motivating factors for the decision to use the app. These were linked to economic issues, "The lady told me to download the app, that I would actually have a few zlotys cheaper" (FGI 3: 776), supporting or facilitating the implementation of planned activities, "In the app I set myself a goal. That I will run this much in a week. Well, and let's say some of our aspirations are then towards that goal" (FGI 1: 601), "What uninstalls the app, its son installs it back. But it had an effect, in six months she lost 10 kg" (FGI 2: 653).

The following network by frequency of occurrence was 'terms'. These covered 15.4% of all positive semantic fields analyzed. Among the terms, phrases such as information value of the app, it is great, no brilliant, apps are cool, it is very motivating, wonderful appeared. Regarding the network of equivalents, one positive expression appeared, 'Such education' (FGI 1: 539). In contrast, the 'oppositions' network contained no positive semantic field.

Characteristics of negative semantic fields

The 'association' network also dominated the negative emotional temperature networks. It covered 55.8% of all negative semantic fields analyzed. Like positive feelings, negative experiences did not differ significantly between the subgroups of people surveyed. Consistent with the piercing economic motives for deciding to install an app, the low benefit or value of the incentives used in the app was negatively perceived by interview participants, "How do you collect these points. It is completely pointless. 2 zloty will be collected? It's already better an hour to earn something more for all this time, as the app has to be opened and given" (FGI 1: 470), "This reward is not worth taking part in" (FGI 3: 852).

Associations with monitoring the behavior of pro-environmental app users also evoked negative emotions among participants. These were represented by the following semantic fields: "Like in China" (FGI 1: 494), "What is this interference, rewarding. Someone is going to rummage through my rubbish?" (FGI 1: 525). Participants also pointed out the possibility of generating situations that will initiate inappropriate behavior: "I bet in our country it would be like that, that people would take pictures of someone else's rubbish and collect points" (FGI 2, Item 531), or situations that will make it difficult to perform simple activities: "I am afraid that it will be all the time... like in the app I will have to buy this public transport ticket. Later on I will have to do in the app that I am eco. And I will miss my bus-stop" (FGI 4: 613).

Semantic fields with a negative emotional temperature also concern the theme related to the number of applications on offer. They were commented on by interview participants as follows: "On the phone, two



screens for the apps alone" (FGI 4: 427), or as an economically unjustifiable undertaking, "Isn't it better to put a couple more vending machines, a couple more bins than to load in an app" (FGI 4: 617).

The second network by frequency of occurrence was 'entity's actions,' containing 16.3% of all negative semantic fields analyzed. This network mainly included statements about the usability of the application. Although the function of sending notifications was perceived as positive, if there were too many notifications, the functionality lost its attractiveness and effectiveness, "Because like once in a while such an app would remind, once in a while. Once a day even can be, that's nice. But you accumulate these notifications, and you look at how many there are, and you get discouraged" (FGI 5: 336).

The reminder, information, and referral system was also negatively perceived from a human development perspective. Participants in the interviews perceived the use of excessive applications as a negative action for society. This was manifested in the following semantic fields, "The worst thing is that all these apps make us stupid because today nobody knows how to get anywhere without Google Maps. Nobody drinks water if the app doesn't remind you" (FGI 2: 656-658). Some respondents also lacked confidence in the effectiveness and actual impact of the app's ability to shape consumer behavior, "And how will the app prove to me that I ate one slice of sausage today?" (FGI 3: 921).

The following network was 'actions towards the entity.' It covered 14.0% of all negative semantic fields analyzed. The respondents' statements mainly concerned two areas. The first was related to the day-to-day inconvenience of dealing with the app, "I was standing and doing traffic jam because I was downloading the app" (FGI 3: 777). The second area was related to the reluctance to undertake the extra steps involved in operating the app, "It was more trouble to run the app every day as I commute to work, and no reward" (FGI 3: 848), "If I had to scan some code 50 times to have 4 zloty cheaper rubbish, even if I do as I do in the app, I wouldn't want to" (FGI 4: 622).

The least numerous networks included 'terms,' 'oppositions,' and 'equivalents.' The first two covered 9.3% and 4.7% of the total negative semantic fields analyzed, respectively. The 'equivalents' network did not contain any negative semantic field. Among the terms that appeared were such as: "Why another app" (FGI 4: 570) or "Unfortunately, I have a lot of loyalty apps" (FGI 1: 480). Whereas among the 'opposition': "Sports apps, for me it's a denial of any idea of sport at all. Sitting in front of a screen to count, to send yourself" (FGI 1: 594), "Like if you order without an app, 51 you have to buy anyway" (FGI 3: 765).

Discussion

The data analysis revealed three categories of users' perceptions: neutral, positive, and negative emotional temperature networks of the word-key 'applications.' Among these, networks with a neutral emotional temperature were the most common. It indicates that apps have become an intrinsic and commonplace part of respondents' lives and, in general terms, do not arouse intensive emotions. Nevertheless, specific aspects or functionalities of the application that provoke positive or negative user attitudes are also apparent. Referring to the first research question, the analysis of the semantic fields identified those aspects that, based on the participants' statements, could be interpreted as advantages of the application. The findings indicate that functionality based on a reward or benefit system undoubtedly reinforces and shapes environmentally friendly behavior. While this is in line with the results of other studies (Barboza and Filho, 2019), the presented research shows that mentioned factor is relevant for any target group, whether strongly or moderately green and for both students and office workers. However, the reward system does not have to be based only on individual financial aspects, it can concern environmental measures (e.g., financing the construction of bird boxes), but it must nevertheless be measurable and noticeable.

Similar to the study by Al-Shamaileh and Sutcliffe (2023), the presented results suggest that users place a high value on the utilitarian features of the app. These include those that reduce the number of actions performed, such as solutions based on quick response (QR) codes, integration of devices, and cards, creation of statements, statistics, and rankings, especially integrating the community. Especially among younger users, using fashionable solutions that are popular among friends and recommended by authority figures is essential. This is why it is becoming necessary to design applications to create tools that make interacting and competing for the environment possible. It is also crucial to design a notification system that both relieves the user of the obligation to remember to perform a given action at a particular time and



is not excessively intrusive to the user. The users consider apps with the above characteristics to be something they would like to use. They make everyday environmental activities easier and more supportive, highly motivating, and have been described as brilliant, wonderful, educational, cool.

The presented findings demonstrate that aspects of the activities related to monitoring user behavior are perceived negatively by the respondents. On the one hand, these are features based on over-stimulating the user, such as notifications sent with high frequency (multiple times per day), over-stressing the user's decision-making, and thus making the person dependent on the need to use the app, forcing additional user activities. Although researchers suggesting the creation of more persuasive green apps (Shevchuk and Oinas-Kukkonen, 2019), it is worth considering at the design stage which features will not cross the acceptable boundary for the user, causing rejection of the app. Our findings also reveal a second aspect of the issues involved in monitoring user behavior. The analysis of the statements made by the interviewees prompts questions about ethical issues. Firstly, they are concerned about how pro-environmental apps can interfere with residents' lives and privacy. Secondly, to what extent will they be effective and not encourage inappropriate behavior based on trying to obtain an unjustified reward?

Conclusion

In light of the results presented, I can conclude that semantic field analysis is a valuable alternative to the most commonly used research methods for deepening and extending information systems knowledge. Although, it can be used much more widely, depending on how the researcher chooses to deploy it. The search for answers to important questions from the point of view of both the developers of modern applications and the educators who use them in the teaching-learning process can be successfully applied to analyzing how users express themselves about applications and in which contexts they use relevant concepts. Particularly useful in this method is the analysis of the emotional temperature of semantic fields, which can be employed to identify the strengths and weaknesses of mobile applications or the factors that facilitate or limit the implementation of specific solutions. Therefore, the study is a significant contribution both to the Information Systems field and the continuous enrichment and refinement of the research methodology.

A limitation of this study is the nature of qualitative research, which prevents generalizations from being made. This study should therefore constitute a particular stage of broader research and serve mainly to develop a tool for conducting quantitative research, which will determine whether the results obtained are appropriate for the selected research group or whether they can be considered representative of a wider group of potential users. Another limitation of the study is the number of coders, which was limited to the author of the article. A larger number of coders might have influenced a more objective classification of individual semantic fields and emotional temperatures. In addition, the presented study accompanies the creation of the application, which will be tested in the cities of Gdańsk, Gdynia, and Sopot. Hence the selected research sample was also represented by residents of the Tricity. Due to the issues mentioned above, it is planned to continue the research shortly, first conducting quantitative research among a pilot group of Tricity residents testing the Greencoin pro-environmental educational application (Duda et al., 2022) developed by the project team, and then extending the research to a group representative of a larger community.

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REFERENCES

- Afreen, C. F. 2021. "Mobile Applications Development," Book Rivers.
- Al-Shamaileh, O., and Sutcliffe, A. 2023. "Why people choose Apps: An evaluation of the ecology and user experience of mobile applications," *International Journal of Human-Computer Studies* (170), 102965.

- Ayalon, O., and Toch, E. 2019. "Evaluating users' perceptions about a system's privacy: differentiating social and institutional aspects," in *Proceedings of the fifteenth symposium on usable privacy and security*, pp. 41-59.
- Barankiewicz, I., Bogdańska-Maciak, M., Perkowska-Klejman, A., Zduńczyk, N., and Żurek, E. 2021. "Dobro dziecka w projekcie Kodeksu rodzinnego – analiza semantyczna pojęcia," *Praca Socjalna* (36:6), pp. 89-107.
- Barboza, M. N. L., and Filho, E. J. M. A. 2019. "Green consumption values in mobile apps," *Journal of International Consumer Marketing* (31:1), pp. 66-83.
- Chan, A. H. Y., and Honey, M. L. 2022. "User perceptions of mobile digital apps for mental health: Acceptability and usability-An integrative review," *Journal of Psychiatric and Mental Health Nursing* (29:1), pp. 147-168.
- D'Arco, M. and Marino, V. 2022. "Environmental citizenship behavior and sustainability apps: an empirical investigation," *Transforming Government: People, Process and Policy* (16:2), pp. 185-202.
- Duda, E., Anacka, H., Kowal, J., and Obracht-Prondzyńska, H. 2022. "Participatory co-design approach for Greencoin educational tool shaping urban green behaviors," *2022 International Conference on Advanced Learning Technologies (ICALT)*, pp. 98-100.
- Fatyga, B. (eds.). 2015. "Praktyki badawcze," Warsaw, Instytut Stosowanych Nauk Społecznych UW.
- Hargittai, E., Piper, A. M. and Morris, M. R. 2019. "From internet access to internet skills: digital inequality among older adults," *Universal Access in the Information Society* (18), pp. 881-890.
- Hirschheim, R., and Klein, H. K. 2012. "A glorious and not-so-short history of the information systems field," *Journal of the association for information systems* (13:4), pp. 188-235.
- Irudayasamy, J., Uba, S. Y., and Hankins, C. A. 2021. "Exploration and Exploitation of Mobile Apps for English Language Teaching: A Critical Review," *English Language Teaching* (14:4), pp. 43-54.
- Kujala, S., and Väänänen-Vainio-Mattila, K. 2009. "Value of Information Systems and Products: Understanding the Users' Perspective and Values," *Journal of Information Technology Theory and Application (JITTA)*, (9:4), 4.
- Mackey, F. 1965. *Language Teaching Analysis*, London: Longmans, Green & Co.
- Matthews, J., Win, K. T., Oinas-Kukkonen, H., and Freeman, M. 2016. "Persuasive technology in mobile applications promoting physical activity: a systematic review," *Journal of medical systems* (40), pp. 1-13.
- McBride, B. B., Brewer, C. A., Berkowitz, A. R., & Borrie, W. T. 2013. "Environmental literacy, ecological literacy, ecoliteracy: What do we mean and how did we get here?," *Ecosphere* (4:5), pp. 1-20.
- McLean, G., Osei-Frimpong, K., Al-Nabhani, K., and Marriott, H. 2020. "Examining consumer attitudes towards retailers' m-commerce mobile applications—An initial adoption vs. continuous use perspective," *Journal of Business Research* (106), pp. 139-157.
- Nieradka, P. 2016. "The use of mobile applications in the group of Generation Y," *Management, Knowledge and Learning Joint International Conference 2016*, pp. 811-819.
- Robin, R. 1980. "Badanie pól semantycznych: doświadczenia Ośrodka Leksykologii Politycznej w Saint-Cloud," in *Język i społeczeństwo*, M. Głowiński (ed.), Warsaw, Czytelnik, pp. 252-281.
- Schomakers, E. M., Lidynia, C., Müllmann, D., and Ziefle, M. 2019. "Internet users' perceptions of information sensitivity—insights from Germany," *International Journal of Information Management* (46), pp. 142-150.
- Senan, D. C., and Nair, U. S. 2016. "Examining Students' Perception of Using Crowdsourcing based Mobile Apps for Environmental Education and Research Experiences," in *24th International Conference on Computers in Education (ICCE)-Think Global Act Local Conference Location Mumbai, India*, pp. 351-356.
- Shevchuk, N., and Oinas-Kukkonen, H. 2019. "Influence on intention to adopt Green IS: Boosting endogenous motivations with persuasive systems design," in *Proceedings of the 52nd Hawaii International Conference on System Sciences*, pp. 2055-2064.
- Stocchi, L., Michaelidou, N., Pourazad, N., and Micevski, M. 2018. "The rules of engagement: How to motivate consumers to engage with branded mobile apps," *Journal of Marketing Management* (34:13-14), pp. 1196-1226.