Cultivating Ethics Sensitivity in Design: Impact of Integrating Ethics Within K-12 Digital Design Education*

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Abstract

The use of persuasion has become ubiquitous within digital technologies to maximize revenue, gather users' personal data, and increase engagement. However, literature has highlighted the phenomenon of dark designs which influence users into acting against their best interests. It has been argued that to address the issue of dark designs in the digital context, there is a need to integrate formal ethics education within design pedagogy and practice. Recent years have seen the introduction of ethics in university level curriculums, but there are few reports of integrating ethics within school education. To address this gap, we developed an educational module on persuasive digital design with integrated content on ethics for Class IX school students. This module was introduced to 419 students enrolled in five public schools in Delhi (India) as part of an introductory digital design course. Two classroom activities were conducted to observe the impact of this educational intervention. In the first activity, it was observed how the impact of ethics education reflected in students' design outcomes. In the second activity, it was found that students became more critical in their normative assessments of designs after being introduced to ethical concerns. The findings show that ethics education integrated within digital design curriculums can cultivate ethics sensitivity. We discuss the implications of these findings for the development of ethics-focused design pedagogy.

Keywords: design education, K-12 education, design pedagogy, digital design, design ethics, philosophy of design

1. Introduction

The use of persuasion has become ubiquitous within digital technologies, such as websites, digital platforms, and mobile applications (Fogg, 2002; Oinas-Kukkonen & Harjumaa, 2009; Verbeek, 2009; Berkovsky et al., 2012; Adaji & Vassileva, 2016). While several applications of persuasion are directed towards helping people (Fogg, 2009), persuasive design is also used for commercial gain – to increase revenues, optimize user engagement and gather users' personal data (Gray et al., 2018). This has led to the emergence of ethically dubious design practices, which have been highlighted in literature under the terminology of 'dark patterns'. Dark designs intend to trick, coerce or manipulate users into acting in certain ways (Mathur et al., 2021; Ahuja & Kumar, 2022). They are

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designed to make people do things they didn't mean to and trick users into performing unintended and unwanted actions (Brignull, 2010; Bösch et al., 2016). The use of dark designs has been reported widely in the digital context, such as mobile games, e-commerce, online advertising, online privacy settings, and home robots (Brignull, 2010; Zagal et al., 2013; Bösch et al., 2016; Lacey & Caudwell, 2019; Mathur et al., 2019).

In the past two decades, there has been significant interest in the ethics of persuasion within digital technologies (Berdichevsky & Neuenschwander, 1999; Verbeek 2009; Mathur et al., 2021). Literature has argued for the need to integrate formal ethics education within design pedagogy and practice, to tackle the issue of dark designs being widely deployed by design practitioners (Gray et al., 2018; 2020). Many universities across the globe have started integrating ethics into digital and computing technology curriculums, such as design, computer science, and artificial intelligence curriculums (Fiesler et al., 2020). However, ethics resources suffer from low adoption rates because they are not yet part of a standard body of knowledge (Pillai et al., 2021). Ethics is often taught as a standalone course, separated from the context of a design or a computer science class. In addition, much of these pedagogical interventions take place at the university level, whereas several students have had an introduction to concepts of digital design and computing within school education itself. There are few reports in literature of ethics being integrated into digital design curriculums in schools. In this article, we argue that ethics-focused pedagogical interventions need to be introduced as early as possible in design education. This can aid the development of ethics sensitivity in students' formative years. The integration of ethics in early design education can also encourage the acceptance of ethical perspectives as an inherent part of design activity, rather than an afterthought.

To address this research gap, we developed an educational module for school students. A 20-hour introductory digital design course was piloted for students of Class IX enrolled in public schools in the city of Delhi (India). As part of this course, we developed a 4-hour module on persuasive digital design in which relevant ethics content was integrated. The module was introduced to 419 students enrolled in five schools, taught over two 2-hour sessions. Through two classroom activities, we investigated the impact of this ethics-focused educational intervention on students' design outcomes and their design assessments. As part of the first activity, students designed an advertisement before and after the introduction of ethical perspectives in the classroom. We report the pre/post differences in design outcomes informed by these ethical perspectives. The second activity investigated the impact of ethics education on students' normative assessments of various designs. We observed that after students were introduced to ethical perspectives, they became more critical of the same persuasive strategy applied in a similar context. These findings indicate that ethics education has the potential to cultivate ethics sensitivity. In the discussion section, we discuss the implications of these findings for the development of ethics-focused design pedagogy.

2. Background and Related Work

2.1 Ethically Centred Design Practice

There is currently a gap between the academic focus of ethics and ethics practice by design practitioners (Gray et al., 2018). Ethical and value-centred approaches (such as critical design, reflective design, value-sensitive design) have emerged primarily from academia and have not been widely adopted in practice (Friedman et al., 2002; Sengers et al., 2005; Shilton, 2012; Bardzell & Bardzell, 2013; Gray, 2016). Historically, lack of communication

between academic and practitioner communities has resulted in poor adoption of available design theory in practice (Stolterman, 2008; Gray et al., 2014). More specifically, the discussion regarding ethical considerations suffers from a similar gap, where academic research is focused on higher level ethical theories and methods, without due regard for the barriers which prevent their adoption in practice. Ethical outcomes in design practice are limited by a range of organizational constraints and conflicts, as well as lack of the ability to anticipate the potential impact of a design (Chivukula et al., 2020). The broader phenomenon of ethics trivialization has also been reported within the information technology industry, where technologists tend to understate ethical concerns to preserve the status quo of business (Ahuja & Kumar, 2021a; Bietti, 2021).

In addition to organizational constraints, there is a lack of knowledge support for designers to be able to perform ethically. Some organizations have articulated codes of professional ethics, such as the Interaction Design Association (IxDA) and User Experience Professionals Associations (UXPA) (IxDA, 2023; UXPA International, 2023). These codes are more focused on practitioner conduct and do not explicitly address ethical issues in design. Moreover, practitioners are only loosely bound by these codes (Gray et al., 2018). The ACM Code of Ethics and Professional Conduct (Association for Computing Machinery, 2023) articulates general principles which should guide practitioners' design of computing technologies. The code highlights that these principles are not an algorithm for solving ethical problems, but rather serve as a basis for ethical decision making. In a similar vein, Buwert (2018) argues that when professional codes of ethics are rigid and decontextualized, they may not serve the design complexity of many design situations. He argues that such professional codes in organizational settings may compromise the ability of the designer to actively address complex ethical issues. They can promote an aesthetic sense of ethicality amongst practitioners, without attending to the dimensionality of ethics in any given design situation. Therefore, according to Buwert, while codes of ethics are a useful starting point, the development of a designer's character is the ideal to be achieved. Van Wynesberghe and Robbins (2014) make similar arguments in support of the designer as ethicist, calling for ethics to take a central place in design activity through the lens of the designer's character, taking into account the uniqueness of the complexity of each design situation.

2.2 Ethics Education in Digital Design and Technology Curriculums

In consideration of the above arguments, educational contexts emerge as a natural starting point to cultivate ethics sensitivity amongst technology designers. The importance of ethics education has been widely acknowledged in fields such as medicine and business (Eckles et al., 2005; Floyd et al., 2013). In recent years, the ethics of digital technologies is beginning to be taught in various universities across the globe. Researchers have developed different pedagogical approaches to garner students' interest in the topic. For example, Sunderland et al. (2013) advocated for a problem-based learning approach to teach ethics in engineering education. Skirpan et al. (2018) piloted novel ethics activities in a computer science classroom and found strong engagement and interest from their students. Garrett et al. (2020) explored two pathways for ethics content in technology education – standalone ethics courses and integrating ethics into technical courses – however, they did not conclude on the preferable approach. Fiesler et al. (2021) argued for the integration of ethics into technical courses, which not only supports in-situ learning but also emphasizes to students that ethical practice is inherently a part of technical practice.

Within curriculums focused on digital technologies, Fiesler (2018) has compiled a live spreadsheet of ethics syllabi taught in approximately 200 courses (as of May 2023) in computer science, human computer

interaction, information science, communication, law, and philosophy departments worldwide. A syllabi analysis of this data shows that these topics include law, policy, privacy, surveillance, philosophy, inequality, justice, human rights, AI, algorithms, design, social impact, and environmental impact (Fiesler et al., 2020). In this article, the authors also reported on the broad contents and goals of ethics-focused courses by analysing the intended learning outcomes from each course. 'Learning outcomes' in the syllabi refer to an explicit statement of what students should know or be able to do by the end of the course. Their analysis revealed eight common types of learning outcomes for ethics education – critique, spot issues, make arguments, improve communication, see multiple perspectives, create solutions, consider consequences, and apply rules. Based on this analysis, they argue that the main goal of ethics courses appears to be to teach students to identify ethical issues and critically evaluate these issues (including multiple perspectives and potential consequences). Communication skills fit into this goal, and practical skills (such as creating solutions and applying rules) support this goal. Similarly, Sonneveld (2016) argued that there are six learning outcomes of teaching ethics in design: (a) ethical sensitivity (ability to recognize situations in which ethical values are at stake), (b) ethical analysis (analysing the ethical aspects of a particular situation), (c) ethical creativity (generating different approaches on how to address ethical issues), (d) ethical judgment (taking an informed and reasonable moral position regarding a situation), (e) ethical decision making (acting in accordance with one's ethical judgment), and (f) ethical argumentation (ability to structure and articulate thoughts, proposals, and actions, and justify them against ethical aspects of a situation).

The importance of ethics education from a younger age has also been highlighted in literature. It has been argued that ethics education in schools is important for the development of children's ethical competence (Burroughs, 2018). Children from a young age differentiate between social and moral concepts and actions (Nucci, 2001; Nucci & Turiel, 2009; Smetana et al., 2014; Turiel, 2014). They generate moral concepts from early experiences of harm and fairness that lead to a prescriptive and generalizable understanding of how individuals ought to behave toward one another. Killen et al. (2018) showed that children around the age of 5-6 start identifying unjust outcomes. School education is typically directed at fostering prosocial behaviors, such as sharing, helping, and comforting others (Burroughs & Barkauskas, 2017). However, psychologists make a distinction between prosocial and ethical behavior (DeVries & Zan, 1994). Even when prosocial behaviors correspond to ethical ends, ethics education is interested in the motivations that come to influence children's behaviors. Hence, Burroughs and Barkauskas (2017) call for an increased focus on educating children to develop and adopt an autonomous ethical orientation with a personal investment in ethical values, motivations, and actions. Autonomous ethical orientations are opposed to heteronomous orientations, which mean that a child's ethical behavior is regulated by an unthinking obedience to authority rather than by personal conviction.

Much of the literature on ethics education in digital technology curriculums focuses on university level courses. However, recent years have seen a pedagogical shift within school education. School students are now being introduced to digital technology, design and computing curriculums. Computing education is available to as young as elementary school students and is common at the secondary school level (El-Hamamsy et al., 2023; Lindberg et al., 2019; Tsukamoto et al., 2015; Zaharija et al., 2013). Sanusi et al. (2022) conducted a systematic review of 43 articles which report teaching machine learning in K-12 education. It was found that only one reported the inclusion of ethics content (Payne, 2019). Digital design education is also beginning to enter the schooling system. There are many e-learning courses freely available on these subjects for school students (Digital

Influx, 2023; Praxent, 2023). Ethics concepts are being integrated within school curriculums as well, however, there are limited studies in the area. In the domain of artificial intelligence (AI) education, Lee et al. (2021) and Zhang et al. (2023) conducted a summer workshop with integrated ethics content for middle school students. They reported strong engagement in ethics related activities focused on unintended consequences and bias. They found that students were able to identify bias and engage with the personal and societal implications of AI. In the same domain, Ali et al. (2019) developed hands-on activities to teach Grade 5-8 students about ethical ramifications of AI. These studies have concluded that incorporating ethics in AI education is age appropriate.

2.3 Research Gap

As highlighted in Section 2.2, the importance of ethics education in schools in widely agreed upon. Further, there have been attempts to integrate ethics concepts within emerging school curriculums on machine learning and AI. However, there is a lack of reports of integrating ethical perspectives within school curriculums focused on digital design. We argue in this article that there is a need to introduce in-situ ethics education within digital design curriculums in schools. To this end, we created and tested an educational module on persuasive digital design with integrated content on ethics. In the next section, we report the contents of our module and the methodology of the two activities. We then report how we analysed the data from the activities and the findings from the same. This is followed by a discussion on the implications of these findings as well as our inferences for the development of ethics-focused design pedagogy.

3. Research Methodology

This research was conducted as part of a 20-hour introductory digital design course piloted for students of Class IX in five public schools in the city of Delhi (India). Several classroom activities were conducted throughout the course to observe the learning outcomes. The intent of the course was to help develop more formal digital design curriculums for K-12 secondary and senior secondary education. None of the activities in the course were assessed or graded, and the students were aware that the course was ungraded. As part of this course, a 4-hour module on persuasive digital design was created, with integrated content on ethics. This module was taught in the classroom over two 2-hour sessions. To investigate the impact of ethics education, two pre/post classroom activities were conducted. The module was introduced to six batches of students in five schools, resulting in a total of 12 sessions.

3.1 Participants

Across five schools, there was a total enrolment of 419 students in Class IX. Class IX students are typically 14 years of age, however, the age of individual students was not collected. Out of the enrolled students, the classroom activities 1 (Advertisement Design) and 2 (Normative Assessment of Designs) reported in this article were completed by 309 and 354 students respectively. The enrolment of students and the number of complete responses to each activity from each school are reported in Table 1.

Table 1 Student enrolment in the course

| School	Enrolment	Responses (Activity 1)	Responses (Activity 2)
1	42	37	38
2a[*]	60	52	48
2b[*]	57	40	50
3	95	50	74
4	99	66	82
5	66	64	62
Total	419	309	354

[*]indicates two batches in school no. 2

3.2 Session Content and Activity Protocols

A 4-hour module on the topic of persuasive digital design was taught to each batch of students over two consecutive days in 2-hour sessions each day. The module taught students how to create persuasive digital designs in the form of persuasive strategies and highlighted the ethical perspectives for the normative evaluation of these strategies. In the first session, the module focused on teaching students how to apply the persuasive strategies taught, as was expected from a design curriculum. The second session highlighted the ethical concerns underlying the very same persuasive strategies. This is an in-situ approach, which centres the knowledge of the ethical impact of designs within a design classroom, as advocated for by prior works (Fiesler et al., 2021; Pillai et al., 2021). For example, Pillai et al. (2021) have argued that developing a fine-tuned perspective of ethics requires an ability to examine the intended as well as unintended consequences of design for individuals, communities and society at large. They argue that ethics is bound to be an afterthought in design practice unless it is integrated in every aspect of the design process and educational curriculum. Hence, the intent of the module was to encourage students to think about ethics while they learnt about design, to emphasize that ethics is an inherent part of design practice. As part of this module, two classroom activities were conducted to observe the impact of ethics education on (a) how students critically evaluate persuasive designs, and (b) how students create solutions to mitigate ethical concerns. Both of these have been argued to be important constituents of learning outcomes within digital technology ethics courses in university level education (Fiesler et al., 2020; Sonneveld, 2016). This structure of the module and the pre/post design of the classroom activities is grounded in constructivist learning theory (Bada & Olusegun, 2015). In this module, ethics-focused knowledge is intended to shift students' perceptions of persuasive designs and allow them to arrive at normative judgments informed by various normative lenses. The activities test the idea that introducing ethical perspectives can change critical evaluations of persuasive designs, as well as introduce reflective thinking which can alter the course of design actions.

First, to observe the effects of ethics education on critical evaluation of designs (an *evaluative* lens), the students assessed various persuasive strategies before and after the introduction of ethical perspectives in the classroom. Previous research with university students suggests that ethics education can promote ethical reflection, making students question their own design choices based on the knowledge of ethical concerns (Ahuja & Kumar, 2024). Álvarez et al. (2022) found that ethics assessments, which are initially guided by intuition, can be influenced or oriented by reflective questions, facts, and social interaction, and ethics education can even change students' original stance towards ethically conflicted scenarios. Hence, this activity was intended to observe if ethics education in a K-12 context can help students reflect over the normative aspects of persuasive designs, and change their critical evaluations after their ethical implications are made explicit or visible. Second,

to observe the effects of ethics education on design outcomes (a *generative* lens), the students completed a pre/post classroom activity in which they designed an advertisement. The aim of this activity was to observe if ethics education can promote reflective thinking within the design process itself, such that a knowledge of ethical concerns can be operationalized to mitigate such concerns. Previous research with university students shows that when students are explicitly prompted with a task to manipulate the user, they can end up taking various 'dark' design roles (Gray et al., 2021). However, when prompted with altruistic aims or sensitized about ethical concerns, they do have the ability to translate ethics and values into design solutions and action (Ahuja & Kumar, 2024; Chivukula et al., 2019). Hence, this activity was intended to observe if ethics education in a K-12 context can help develop this ability to utilise the knowledge of ethical concerns while creating design solutions.

Fig. 1 summarizes the research methodology of this research. It depicts the temporal flow of the two sessions, including the a) classroom concepts, b) classroom activities, and c) the analysis of the classroom activities. The detailed content of the educational module was as follows.
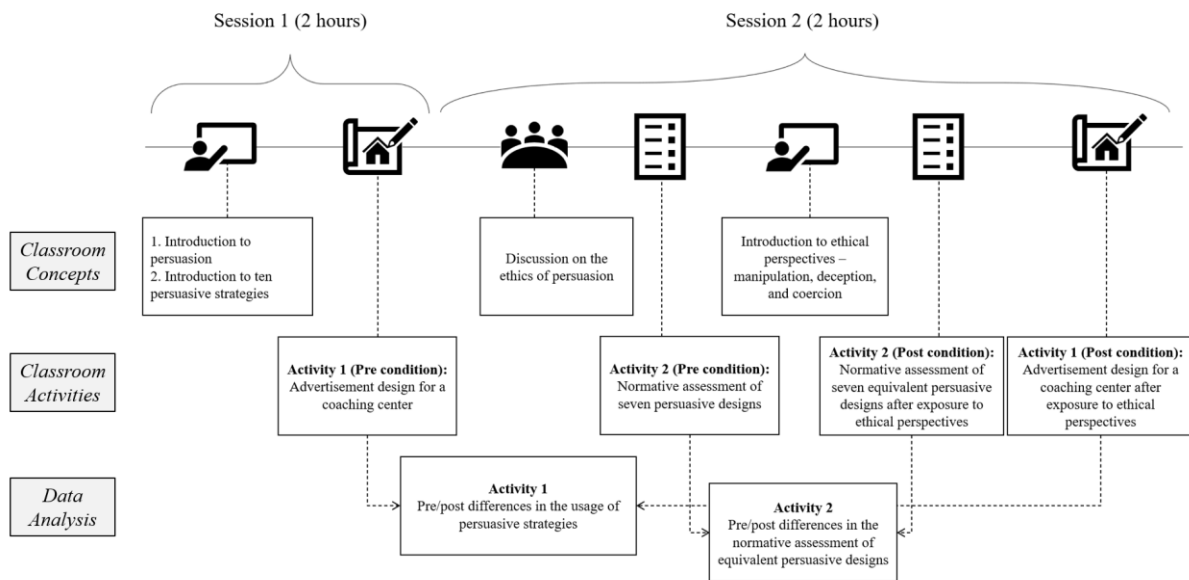
Fig. 1 Research Methodology

3.2.1 Session 1

The first session was dedicated to the topic of persuasion in digital design. Students were familiarized with the concept and applications of persuasion. They were taught strategies for designing persuasions. The temporal flow of the session was as follows.

1. *Introduction to Persuasion:* The class was begun with examples of digital platforms which students were familiar with, such as Facebook, Instagram, Snapchat, Google, and YouTube. We discussed designs that many students had been exposed to, such as 'like' buttons on social media, popup advertisements and premium subscription popups. Through examples, we attempted to create an intuitive understanding of the concept of persuasion and to let the students perceive the intentionality behind such designs. We introduced potential reasons why a designer might want to persuade their users, including commercial gains as well as for helping people. To help students internalize the concept of persuasion, we asked them

to reflect on their past experiences and make a list of ten persuasive designs that they had encountered in the physical and the digital world. This helped the instructor bridge gaps of understanding. This activity was discussed in the classroom but was not analysed for research purposes.

2. *Introduction to Persuasive Strategies:* We introduced the students to different strategies which they could use as designers to persuade users. There are several books and publications which provide a compilation of persuasive strategies which can be used to teach persuasion in the classroom (Goldstein et al., 2008; Cialdini, 2009; Weinschenk, 2009). However, for school students, we found it effective to teach persuasive strategies through applied examples. For this purpose, we walked the class through the flight booking process of a travel website. Within this process, we identified the use of ten persuasive strategies, and we only exposed the students to these ten strategies. We explained the workings of each strategy through the example of its application within the flight booking process. This allowed the students to observe how a 'strategy' could be operationalized using different design elements such as fonts, labels, navigation, language, icons, etc. Table 2 lists the ten strategies that were taught in the classroom, along with a few examples of their applications which helped students understand how each strategy worked.

Table 2 Persuasive strategies introduced in the classroom

Persuasive Strategy	Examples
Rewards	discounts, incentives, cashbacks, points, free items, gifts, etc.
Fear	evoking fear through language, scarcity, urgency, etc.
Selling Addons	additional items, combo items, extra charges, etc.
Repetition	nagging, interrupting, reminding, etc.
Defaults	default charges, default addons, default settings, etc.
Visibility	font, emphasis, navigation, hidden information, etc.
Exaggeration	exaggerating value, quality, aesthetics, feasibility, results, etc.
Social Proof	feedback, testimonials, ratings, reviews, etc.
Positive Framing	positive language, biased language, etc.
Last Minute / Hidden Charges	full charges not shown, shown on last page, etc.

3. *Advertisement Design (Activity 1, Pre Condition):* Nearing the end of the first session, the students were asked to design an advertisement for a coaching centre using one or more of the persuasive strategies discussed in the class. This was a pen and paper activity, and the students were provided with A4 sheets, pencils and sketch pens. These activity sheets were submitted by the students.

3.2.2 Session 2

The second session was dedicated to the introduction of ethical perspectives. The temporal flow of the session was as follows.

1. *Discussion on the Ethics of Persuasion:* We began the session by asking students if they detected a sense of wrongness with some of the persuasive strategies taught in the previous session. We openly discussed students' raw perceptions of right and wrong regarding persuasion. This way, we made explicit the existence of ethical concerns but did not yet provide the students with the perspectives or the vocabulary to think about the ethics of persuasion.

2. *Normative Assessment of Designs (Activity 2, Pre Condition):* At this stage, we sought to gather students' initial assessments of the ethics of persuasive designs. This was also a pen and paper activity, in which

students were asked to provide their assessment of the ethics of seven different designs (Fig. 2a-2g). The seven designs were shown one by one to students on a PowerPoint presentation. Students were asked to rate each design on a 5-point scale of [1] Very Unethical to [5] Very Ethical.

3. *Introduction to Ethical Perspectives:* After this activity, the students were formally introduced to ethical perspectives for the assessment of persuasive designs. Within this session, we introduced students to three concerns which are widely discussed in literature – deception, coercion, and manipulation (Susser et al., 2019; Ahuja & Kumar, 2021b; Mathur et al., 2021). We discussed examples of each, and the potential ways in which each concern was operationalized in design. For example, deception could occur by lying or hiding information, coercion could occur though restrictions or pressure, and manipulation through tricking or misleading the user. We aimed for the students to internalize the concepts of deception, coercion, and manipulation in a way that they could later apply them to the assessment of any design. We then discussed in the class whether the ten persuasive strategies from Table 2 were ethical or not, in light of these three ethical concerns. It was made explicit that the instructor was not seeking unanimous agreement among the students on the ethics of each strategy, but an active reflection on each strategy in consideration of the specified ethical concerns.
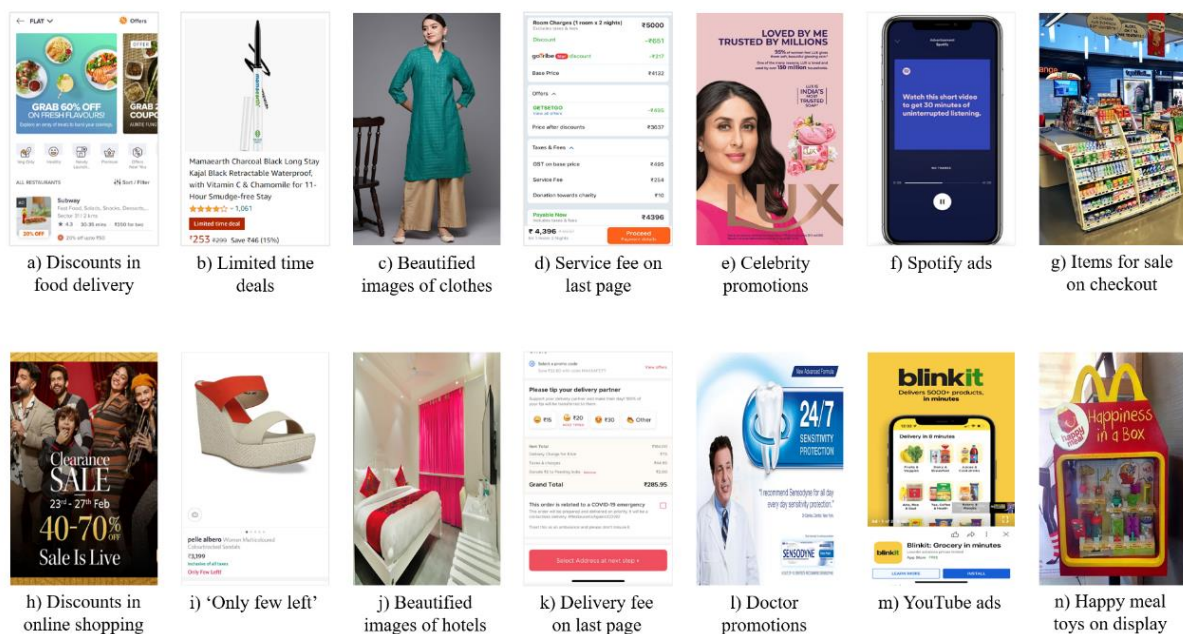

Fig. 2 Persuasive designs for normative assessment in Activity 2 (Fig. 2a-2g correspond to pre condition and Fig. 2h-2n correspond to post condition)

4. *Normative Assessment of Designs (Activity 2, Post Condition):* We then asked the students to rate seven more persuasive designs (Fig. 2h-2n) on a 5-point scale of [1] Very Unethical to [5] Very Ethical. Each of these seven designs chosen for assessment in the post condition was equivalent to one of the seven designs in the pre condition (Fig. 2a~2h, 2b~2i, …and so on) in terms of the persuasive strategy used and similar in the context of application. At this stage, while providing their assessments, students were asked to reflect upon whether a design was deceptive, coercive, or manipulative.

5. *Advertisement Design (Activity 1, Post Condition):* Nearing the end of the second session, the students were asked to redesign their advertisements for the coaching centre that they had designed in the previous

session. They were again provided with A4 sheets, pencils, and sketch pens. They were instructed to reflect on their earlier designs and be mindful of ethical concerns. On the back of the A4 sheet, the students were also asked to provide an explanation for the changes made. These activity sheets were also submitted by the students.

3.3 Analysis

The data analysis pipeline for activities 1 and 2 is summarized in Fig. 3. The following subsections detail the methodology for data analysis of both activities.
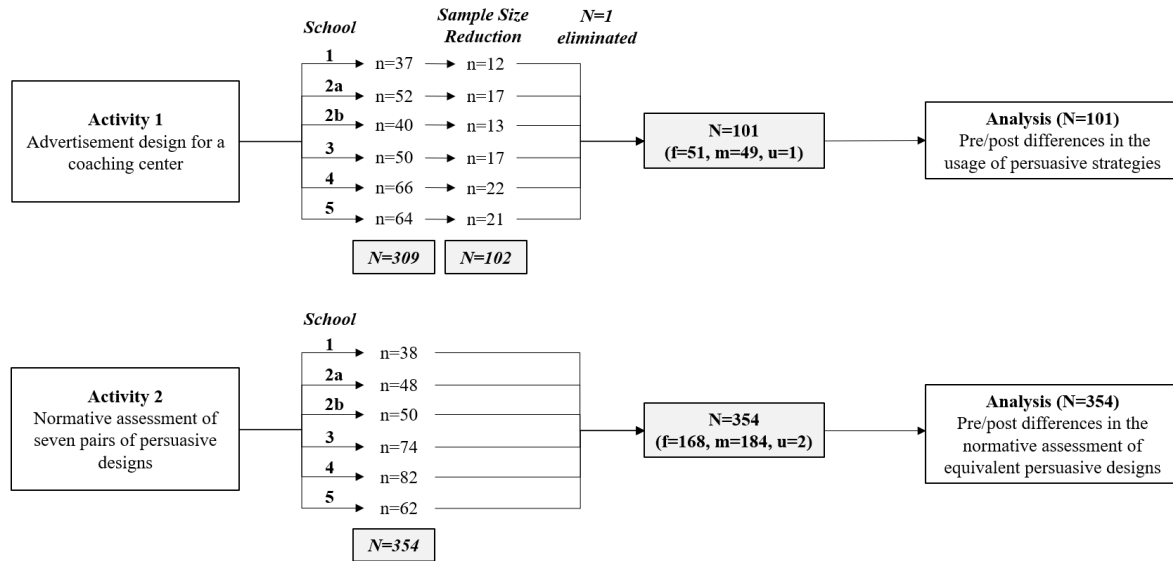
Fig. 3 Data analysis pipeline for classroom activities 1 and 2

3.3.1 Activity 1: Advertisement Design

For Activity 1, we analysed the pre and post advertisement designs submitted by the students. The students designed advertisements for various kinds of coaching centres, such as academics, dance, music, cooking, etc. For this activity, we received 309 complete submissions (a submission was considered complete when a student submitted both pre and post activity sheets). Due to the large sample size of this data, it was decided to reduce the sample size for analysis. For each of the six batches of students from Table 1, we randomly selected one-third of the complete submissions, rounded off to the nearest integer. This resulted in the selection of 102 submissions. One of these submissions was further eliminated because the student did not fulfil the activity brief and designed an advertisement for a food delivery service instead of a coaching centre. This resulted in a final sample size of 101 (51 females, 49 males, 1 unknown). The aim of the analysis of Activity 1 was to identify the differences in advertisement designs before and after the introduction of ethical perspectives. To fulfil this aim, we conducted an evaluation of the usage of persuasive strategies in the two conditions.

Qualitatively, we observed that within the pre condition, the students had used one or more of the ten persuasive strategies to design their advertisements. Within the post condition, the students either eliminated the use of certain strategies or altered the way they were applied to mitigate ethical concerns. To quantify these differences, the first author coded each of the 101 pre and 101 post activity sheets on the usage of the ten strategies

from Table 2. The codes described with specificity how each of strategy had been designed into the advertisement. After all the sheets were coded, all the codes pertaining to each strategy were gathered. This collection of codes represented the different designs used by students to operationalize each strategy. Some of these designs were more 'aggressive' than others. An aggressive tactic is one that *"significantly impairs or is likely significantly to impair the average consumer's freedom of choice or conduct in relation to the product concerned through the use of harassment, coercion or undue influence"* and *"causes or is likely to cause him to take a transactional decision he would not have taken otherwise"* (The National Archives, 2008). A scoring scheme was developed to quantify how aggressively each strategy had been applied within each activity sheet. If a particular strategy was used within a sheet, it was rated on a 5-point Likert scale [1-Very Mild, 2-Mild, 3-Moderate, 4-Aggressive, 5-Very Aggressive]. For example, for the 'rewards' strategy, a '10% discount' was rated as 1, and a 'free trial, free refreshments and free musical instrument after three years of enrolment' was rated as 5. The complete scoring scheme for each of the ten strategies is provided in Table 6 in the Appendix. The first author rated all the submissions (101 students, 202 activity sheets) using this scoring scheme. Each sheet was rated on ten parameters (ten strategies). A second researcher rated 20% of the data (20 randomly selected students, 40 activity sheets) on these ten parameters using the scoring scheme. The inter-rater agreement for 400 data points using Cohen's weighted κ was found to be 0.827 (near perfect agreement) (Cohen, 1968). However, since each student had used only a few of the ten persuasive strategies, 285 data points were rated zero [0] by both raters. For the 115 non-zero data points, Cohen's weighted κ was found to be 0.610 (substantial agreement). We then conducted two tailed paired t-tests on these scores to identify which strategies were significantly altered by the students to mitigate ethical concerns.

3.3.2 Activity 2: Normative Assessment of Designs

For Activity 2, we analysed the ratings submitted by the students for the normative assessment of seven designs each in the pre and post condition (Fig. 2). For this activity, we received 354 complete submissions (a submission was considered complete when a student submitted all 14 ratings legibly), and we analysed the complete sample size of 354 (168 females, 184 males, 2 unknown). The aim of the analysis of Activity 2 was to investigate whether students' normative assessments of equivalent persuasive designs became more critical after the introduction of ethical perspectives. This analysis helped observe if ethics education can make explicit ethical concerns which may not be otherwise transparent, and hence change students' critical perceptions towards persuasive designs. For this purpose, we calculated the mean rating given by students to each design from Fig. 2. We then conducted tests of significance to observe if the normative assessments of Fig. 2h-2n in the post condition were more critical, i.e., received lesser scores, than the assessments of corresponding Fig. 2a-2g in the pre condition. We conducted two tailed paired t-tests to observe if there was significant reduction in the mean ratings of each pair of equivalent persuasive designs (Fig. 2a~2h, 2b~2i, …and so on).

4. Results

4.1 Activity 1: Advertisement Design

This section reports the pre/post differences in the usage of ten persuasive strategies from Table 2 within the advertisement designs from Activity 1 (N=101). Each advertisement was rated on how 'aggressive' the usage of each strategy was within the design. The total score of each advertisement was calculated as the sum of the ratings

of the ten strategies. Each student only used some of the ten strategies within their advertisement designs. Table 3 reports the number of students who used each strategy and the pre and post mean scores of each strategy. It also reports the pre and post mean of the total scores of the 101 submissions. Two-tailed paired t-tests were conducted to identify the strategies which were significantly altered by the students in their attempt to mitigate ethical concerns. The p-values were only calculated for strategies which were used by more than 10 students (n>10) and are reported in Table 3. Effect sizes were also calculated using Cohen's d for strategies which showed a significant difference (p<0.05) between the two conditions (Cohen, 1988).

Table 3 suggests that there was a significant total reduction in the usage of persuasive strategies, with a moderate effect size (Cohen's d = 0.575). The most frequently used strategies (n>10) were 'rewards' (n=87), 'exaggeration' (n=52), 'positive framing' (n=32), 'fear' (n=29), 'visibility' (n=23), 'selling addons' (n=18), and 'social proof' (n=14). Out of these, the usage of 'rewards', 'exaggeration', 'fear', and 'visibility' was significantly less aggressive in the post condition. However, the effect sizes differed, with large effect sizes for 'visibility' and 'fear', moderate for 'exaggeration' and small for 'rewards'. No differences were found in the usage of 'positive framing', 'selling addons', and 'social proof'. The remaining strategies such as 'last minute / hidden charges', 'repetition', and 'defaults' were not used frequently (n<10). The 'other' category primarily included strategies which were not taught in the class, such as invoking 'trust' or 'authority'.

Table 3 Pre/post mean of the usage of ten persuasive strategies in advertisement design (N=101)

Persuasive Strategy	n	Pre mean	Post mean	p-value	Cohen's d
Rewards	87	2.64	2.16	0.013[*]	0.322
Fear	29	1.86	0.69	0.000[*]	0.983
Selling Addons	18	2.28	1.83	0.392	-
Repetition	3	2.67	0.00	-	-
Defaults	0	-	-	-	-
Visibility	23	2.61	0.52	0.000[*]	1.863
Exaggeration	52	2.27	1.50	0.002[*]	0.545
Social Proof	14	3.07	2.14	0.066	-
Positive Framing	32	1.16	1.22	0.757	-
Last Minute / Hidden Charges	5	1.00	0.40	-	-
Others	7	1.71	0.71	-	-
Total Score	101	6.01	4.03	0.000[*]	0.575

[*]significant at p<0.05, two-tailed, paired t-test

To investigate if there were any gender differences in the findings, we calculated the pre and post mean of the total scores of the advertisements segregated by gender. Significant differences were not found in the total scores of females and males between the pre and post conditions (Fig. 4). This implies that there was no significant difference in the degree to which male and female students altered their designs to mitigate ethical concerns.
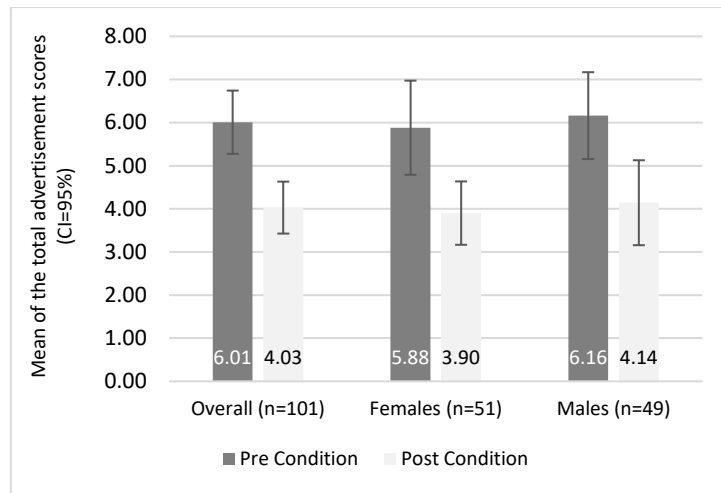
Fig. 4 Pre/post mean of the total advertisement scores segregated by gender

4.2 Activity 2: Normative Assessment of Designs

This section reports the differences in the normative assessment of seven pairs of persuasive designs that were rated by the students before and after introduction of ethical perspectives. Table 4 reports the school-wise mean of the average rating of the seven designs in the pre and post conditions. This analysis shows that students of five out of six batches in five schools became significantly more critical of equivalent persuasive designs after being exposed to ethical concerns.

Table 4 School-wise pre/post differences in the normative assessment of designs

School	n	Pre mean (Fig. 2a-2g)	Post mean (Fig. 2h-2n)	p-value
1	38	2.72	2.67	0.446
2a	48	2.88	2.60	0.000*
2b	50	2.93	2.79	0.047*
3	74	3.07	2.53	0.000*
4	82	2.99	2.73	0.000*
5	62	2.95	2.48	0.000*
Total	354	2.95	2.63	0.000*

*significant at $p < 0.05$, two-tailed, paired t-test

Table 5 reports the mean rating of each of the seven pairs of designs across all batches of students. This table shows that normative assessments of four designs (out of seven) became more critical in the post condition. The underlying strategies of these four designs are 'rewards' (Fig. 2a and 2h), 'fear' (Fig. 2b and 2i), 'authority' (Fig. 2e and 2l) and 'visibility' (Fig. 2g and 2n). No significant differences were observed in the normative assessment of the remaining three designs, which included the strategies 'exaggeration' (Fig. 2c and 2j), 'last minute charges' (Fig. 2d and 2k) and 'repetition' (Fig. 2f and 2m). It is notable that these three strategies are also the lowest rated in both conditions, which signifies that they are perceived to be the most unethical. Ethics education did not introduce additional criticality towards them in our findings, potentially because their ethical impact was relatively transparent to the students in the pre condition. These findings suggest that differences in critical assessment between the two conditions are indicative of an increase in sensitivity, especially towards designs whose ethical impact is not immediately obvious.

Table 5 Pre/post differences in normative assessment of seven pairs of persuasive designs (N=354, 5 schools)

Persuasive design (Pre)	Persuasive design (Post)	Pre mean	Post mean	p-value
2a: Discounts in food delivery	2h: Discounts in online shopping	4.10	3.36	0.000*
2b: Limited time deals	2i: 'Only few left'	2.99	2.66	0.000*
2c: Beautified images of clothes	2j: Beautified images of hotels	2.47	2.38	0.223
2d: Service fee on last page	2k: Delivery fee on last page	1.99	1.99	0.908
2e: Celebrity promotions	2l: Doctor promotions	3.10	2.57	0.000*
2f: Spotify ads	2m: YouTube ads	2.18	2.25	0.394
2g: Items for sale on checkout	2n: Happy meal toys on display	3.81	3.18	0.000*

*significant at $p<0.05$, two-tailed, paired t-test

To investigate if there were any gender differences in the findings, we calculated the mean of the average rating of the seven designs in the pre and post conditions segregated by gender (Fig. 5). We found that there were no significant differences between the ratings of females and males in the pre condition (pre mean, females = 2.95; pre mean, males = 2.94). In the post condition, females were found to be more critical in their assessment (post mean, females = 2.57; post mean, males = 2.68; p-value = 0.033). The gender differences were small (Cohen's d = 0.228) (Cohen, 1988). This finding is consistent with literature that underrepresented minorities and women tend to be more interested in issues that address societal and ethical concerns (Drake et al., 2005; Olds & Miller, 2004; Seymour, 1999). However, it has not been explored further in the article.
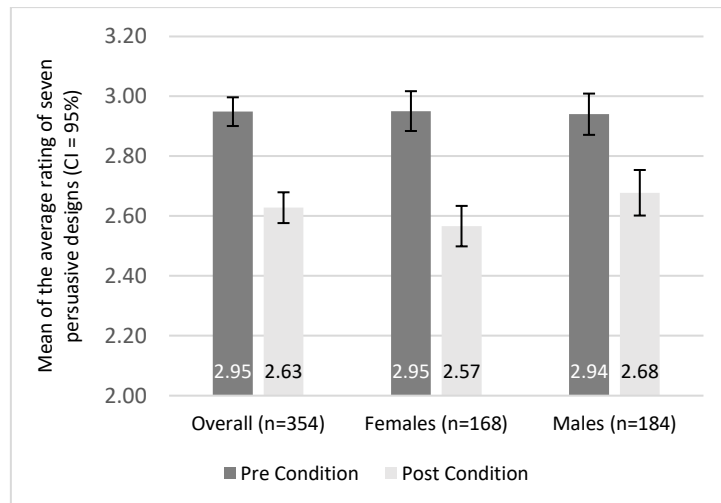
Fig. 5 Pre/post mean of the average rating of seven designs segregated by gender

5. Discussion

5.1 Implications of the Findings

The two classroom activities reported in this article investigated the changes in the design outcomes of students and in their normative assessments of designs after an ethics-focused educational intervention.

The findings of Activity 1 show significant changes in the advertisements designed by the students after they were explicitly directed to be mindful of ethical concerns. They show that students reduced the aggressiveness of the persuasive strategies they found unethical. In order of effect, these strategies were 'visibility', 'fear', 'exaggeration' and 'rewards'. This suggests that students actively reflected upon each aspect of their advertisement design and altered the course of their design solutions in light of the underlying ethical concerns.

This is potentially because in-situ introduction of ethical perspectives allowed them to reflect over their own designs and make changes accordingly. Hence, these findings indicate that when students are sensitized about ethics, they can utilise this knowledge and learn to mitigate ethical concerns in their own design process. These findings are also in line with previous research conducted with university students, which shows that students can indeed translate or operationalize the knowledge of ethics and values into design solutions (Ahuja & Kumar, 2024; Chivukula et al., 2019). In this activity, many students also provided written explanations for why they altered the use of a particular strategy, allowing us to observe the nature of the reflective process that took place while redesigning the advertisement. In addition, the findings also suggest that students used the ethics concepts as a normative lens to arrive at their own judgments and not as a rigid guideline. Only four strategies showed a significant reduction, and with varying effect sizes. First, this shows that students made an active assessment of the type of strategy they found unethical. Second, in their design activity, they reflected upon ways to make the strategy less aggressive rather than simply eliminate its usage. This finding is relevant because it shows that ethics education can aid in the development of both ethical competence and an autonomous ethical orientation (Burroughs, 2018; Burroughs and Barkauskas, 2017).

The findings of Activity 2 show that students became significantly more critical in their normative assessments of designs after introduction to ethical concerns, even though they were evaluating the same persuasive strategies with nearly equivalent applications. This is potentially because ethics education acts as a tool of awareness as well as empowerment. At the very least, it can create awareness about the nature of ethical concerns and how they surface in design applications. This means that it can make visible the ethical impact of a design, based on which it can alter critical evaluations of such designs. More broadly, ethics education can help students spot or observe the problematic aspects of a design, contributing towards enhanced criticality. This finding is in line with existing literature. In this activity, it can be argued that students' assessments in the pre condition are guided by intuition, however, a knowledge of facts and reflective questions can help orient their normative stance towards various design strategies (Álvarez et al., 2022). In addition, ethics education might also have a motivating effect, empowering students to critique such designs more deeply. However, the pre/post differences were not found to be uniform across all designs. The effects may be more prominent for designs whose ethical impact is not immediately obvious or transparent in the pre condition (as previously highlighted in Section 4.2). This finding is encouraging because it suggests careful reflection at the time of assessment rather than a disproportionate criticality towards all types of strategies.

5.2 Considerations for Ethics-Focused Design and Technology Education

In addition to the findings from the two activities, these sessions also allowed the authors to reflect upon their experience of educating a young cohort of students towards ethics in digital design. As a result, we arrived at the following considerations for ethics-focused design and technology education.

- We found that students as young as 14 years old harbour intuitions about ethical concerns. This observation is consistent with previous literature (Killen et al., 2018; Nucci, 2001; Nucci & Turiel, 2009; Smetana et al., 2014; Turiel, 2014). At the beginning of the second session, it was observed that several students detected a sense of wrongness with the persuasive strategies taught in the first session. However, they could not articulate this intuition in the form of underlying ethical concerns. The introduction of

ethics concepts provided the students with a normative lens with which to reflect over their design activity (Activity 1) and that of others (Activity 2). Hence, we concluded that ethics education can provide students with the normative foundation and the shared vocabulary to understand the ethical impact of any design.

- We observed that in-situ ethics education made it easier for students to connect ethical concerns with design applications. It allowed them to understand how ethical concerns operationalize in design and how they can emerge in their own design activity. Even through a broad normative lens, students were able to incorporate changes in their design activity (Activity 1) and arrive at a critical assessment of designs (Activity 2). These findings reinforce importance of integrating ethics content within design and technology courses, as has been argued by Fiesler et al. (2021). They also help address a prevailing criticism against ethics in design practice – that ethics is too abstract and inaccessible to technology designers (Ahuja & Kumar, 2021a). Our findings suggest that in-situ ethics education might be one of the ways in which ethics can be made less abstract and more accessible to the audience of students and professionals.

- A valuable learning for us was to avoid a prescriptive approach in the classroom and provide a space for students to arrive at their own assessments. Various forms of 'unethical' designs are widely used and accepted in everyday life. In addition, students are often conflicted in their role as designers and their experiences as users. As such, even if a design application if bothersome, they may find it difficult to label it as unethical. We concluded that ethics education should first play a sensitizing role rather than a prescriptive one. The first goal of education should be to reveal the ethical impact of a design that has been obstructed from view by a purely technical approach to education.

- Lastly, we conducted these sessions on the topic of persuasive digital design. The choice of this topic was motivated by the nature of the course (Introductory Digital Design). However, it is plausible that these findings can generalize for ethics education in other design and technology curriculums. The core inference from the findings is that ethics education can help enhance ethics sensitivity of design students. It can unmask the ethical impact of design and hence, enhance students' criticality towards design applications. It can also encourage students to reflect on their own position as designers, such that students are motivated to alter their design activity to mitigate ethical concerns.

5.3 Limitations of this Research

The article is focused on persuasion within digital design, and there is a need to conduct such studies within other domains of design and technology to establish the impact of ethics education. Even within this topic, the duration of the sessions was not enough to sensitize students to the nuances of ethical concerns and discuss how to resolve ethical trade-offs and dilemmas. Various ethical concerns have been discussed in literature in relation to persuasion – such as agency, freedom of choice, authenticity, independence, and control (Ahuja & Kumar, 2022; Vugts et al., 2020). However, we only discussed two aspects in the class – agency (deception and manipulation) and freedom of choice (coercion). We did not discuss other ethics concepts, in the interest of time and considering the capacity of the students. Within the classroom, our aim was to encourage reflection and not to introduce ethical complexity. Another limitation was that within Activity 1, we could not observe the differences in the usage of strategies which were used less frequently, such as 'last minute / hidden charges', 'repetition' and 'defaults'.

These strategies were not frequently designed into the advertisements because they were not conducive to application in a pen and paper activity.

6. Conclusions

In this article, we developed an educational module on the topic of persuasive digital design as part of an introductory digital design course for Class IX school students. The module was split into two 2-hour sessions, in which we introduced students to concepts of persuasion and persuasive strategies, as well as integrated ethics content into this educational module. The aim of this article was to test the impact of ethics education in the classroom through two classroom activities. In Activity 1, we found significant differences in students' design outcomes in an attempt to mitigate ethical concerns. In Activity 2, we found a significant increase in students' critical assessment of designs. We inferred from the findings that integrating ethics concepts within a design classroom provides students with the requisite lens to evaluate their design activity and mitigate ethical concerns. To the best of the authors' knowledge, the integration of ethics content within K-12 digital design education is a relatively novel intervention. The findings of this research are encouraging for the development of more directed efforts to introduce ethics in digital design and technology curriculums starting right from school education. To further research in the area, similar studies need to be conducted across students of different ages and with different topics to establish the impact of ethics education.

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Appendix

Table 6 Scoring scheme for each of the ten persuasive strategies [1-Very Mild, 2-Mild, 3-Moderate, 4-Aggressive, 5-Very Aggressive]

Persuasive Strategy	Scoring Scheme
Rewards	[1] Up to 10% discount; Less than 1 week free trial; Nominal free items such as notes, access to library, registration
	[2] Up to 30% discount; 1-2 week free trial; Excessive free items such as extra classes; Combination of 1-rated items
	[3] Strategic discounts such as based on scholarship tests, first come first serve, combination of subjects, admission of more than one student, student background, discounts on extra purchases; Money back claims; Excessive discounts from 50% to 100%; Combination of 1-rated and 2-rated items
	[4] Random discounts based on lotteries; Free trial for 1 month or more; Combination of 1-rated, 2-rated, and 3-rated items
	[5] Combination of 1-rated, 2-rated, 3-rated, and 4-rated items
Fear	[1] Urgency and scarcity inducing statements without any fixed end date of offers
	[2] Urgency and scarcity inducing statements with fixed end date or fixed number of students for offers; Uncertainty about the offer amount
	[3] Offers limited to today; Teasing statements about children's failure and future; Combination of 1-rated and 2-rated items
	[4] Combination of 1-rated, 2-rated, and 3-rated items
	[5] None
Selling Addons	[1] None
	[2] Selling items that are not expected to be included such as extra classes and books
	[3] Discounts on subjects combinations and multiple siblings
	[4] Very expensive personal teacher; Selling items that are expected to be included such as sample exam papers, advanced math, notes; Combination of 1-rated, 2-rated, and 3-rated items
	[5] None
Repetition	[1] None
	[2] Mentioned discount twice
	[3] Mentioned discount or free trial thrice
	[4] None
	[5] None
Defaults	Not applicable
Visibility	[1] Highlighted positive information such as discounts
	[2] Terms and conditions written in small font
	[3] Coaching fee, admission fee written in small font

	[4] Addons and their cost written in small font, such as notes, extra classes; Combination of 1-rated, 2-rated, and 3-rated items
	[5] Combination of 1-rated, 2-rated, 3-rated, and 4-rated items
Exaggeration	[1] Generic claims, such as *best education, best teachers, smart classes*, etc.
	[2] Specific claims, such as *making students perfect in accounts, cracking NEET exam*, etc.; Combination of 1-rated items
	[3] Claims about results, such as 95% marks, 100% results, assured employment, learning English in 3 months, etc.; Exaggerated discounts, such as up to 80% off; Combination of 1-rated and 2-rated items
	[4] Combination of 1-rated, 2-rated, and 3-rated items
	[5] Combination of 1-rated, 2-rated, 3-rated, and 4-rated items
Social Proof	[1] 3-starred honest reviews by old customers; Both top and moderate past results shown
	[2] None
	[3] Past results and images of toppers
	[4] Past results and images of toppers along with added statements such as *enrol now to be in this list*
	[5] Past results and images of toppers along with star rating of teachers
Positive Framing	[1] Encouraging statements such as *let's rock, better education to better future, open your wings* etc.
	[2] Descriptive adjectives about the coaching and teachers such as *best, smart, qualified, modern, well-educated, expert,* etc.; Combination of 1-rated items
	[3] Combination of 1-rated and 2-rated items
	[4] Combination of 1-rated, 2-rated, and 3-rated items
	[5] None
Last Minute / Hidden Charges	[1] Admission fee (small amount)
	[2] Fee mentioned excluding taxes
	[3] None
	[4] None
	[5] None
Others	[1] Use of statements such as *licensed to build trust*
	[2] None
	[3] None
	[4] Use of a verified seal; Awarded by celebrities
	[5] None