THE BEST PRACTICE OF TEACH COMPUTER SCIENCE STUDENTS TO USE PAPER PROTOTYPING

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Abstract

The importance of understanding the repercussions of effective user interface (UI) design is critical for future Computer Science (CS) professionals, given the ubiquity of interfaces on computer devices. Through a paper prototyping activity, this article explains how to teach rapidly and successfully CS students about "fit," a Human-Computer Interaction (HCI) concept. Despite its simplicity, the concept of "fit" can be difficult to grasp without much practice. In practice, designing "fit" into UIs can be prohibitively expensive because workable prototypes are generally beyond the technical capabilities of students. As a result, we illustrate how to use paper prototyping to demonstrate "fit" in a hands-on class exercise based on active learning concepts. To guide students through the process of "fit" in UI design, we provide extensive step-by-step directions for planning, setting up, and presenting the exercise. Students will be better equipped to apply both theoretical and practical applications of "fit" in UI design and execution as a result of this assignment; this exercise can be used in any course that covers user interface design, such as concepts of human-computer interaction, systems analysis and design, software engineering, and project management.

Keywords: Paper Prototyping, Best Practice, Computer Science, Students To Use of Teach.

INTRODUCTION

Given the prevalence of computing devices in practically every part of our lives, how people interact with these devices is vital to all computing fields. In fact, failing to account for interface usability can result in a variety of issues ranging from minor annoyances to outright disasters. Common computing interfaces, such as Windows, Apple devices (particularly Apple Watch and Apple Maps), Smart TVs, and social media, have been noted as having poor usability (Ahmad, Al-Sa'di, & Beggs, 2020; Al-Sa'di, 2018; Burton, 2016; Pogue, 2016). Poor design, apart from small annoyances, can have devastating repercussions. For example, in 1988, the US Navy shot down an Iranian civilian jet owing to a poor visual display (Pogue, 2016); while in 2003, Space Shuttle Columbia burned up upon re-entry, partly due to a poorly designed PowerPoint presentation (Park, 2015).

The study of "how humans engage with technology for a variety of reasons" is known as Human-Computer Interaction (HCI) (Zhang and Li, 2005, p. 228). The core phenomenon of interaction is the user interface (UI), which integrates human objectives with computing resources. The practical goal of HCI is to "provide high usability for users of computer-based systems" (Hartson, 1998, p. 103). In connection to a goal or desired outcome, usability is defined as the amount of satisfaction, efficiency, and effectiveness that an information system (or its components) provides to a user (Al-Sa'di, 2018; International Organization for Standardization, 1998). To build and assess "better, more effective" technologies (Cooper et al., 2014, p. XXIII) that minimise dissatisfaction (or even disaster) and encourage well-being, it is critical to understand how people's talents and limits affect interface usability. While people who work in the field of information systems (IS) should know better, given the prevalence of badly designed interfaces, all computer professionals might benefit from learning more HCI ideas.

Chan, Wolfe, and Fang (2002) emphasise the importance of teaching HCI and usability-related issues in IS, claiming that graduates must have a complete grasp of these topics. Working alongside developers to build efficient and effective systems, for example, CS students must grasp how crucial UI design is, as well as how to choose and appraise current tools to "fit" and facilitate operations. As a result, students should learn basic HCI concepts through training that allows them to practise "methods and skills to grasp present users, experience non-use, and imagine future users" (Faiola, 2007). (Churchill, Bowser, and Preece, 2016, p. 70). Practical

training in UI design and assessment, on the other hand, is frequently overlooked. HCI, for example, is solely an option in the 2010 CS Model Curriculum (Janicki, Cummings, and Healy, 2015).

The empathic element of systems design and implementation is perhaps not one of the more notable aspects of the CS curriculum, with a significant focus on technical features of technology and other essential business-oriented topics such as project management (Al-Sa'di & Parry, 2017). The interaction between designers and users may be mentioned in passing during the requirements engineering and validation phases of the systems development life cycle, but HCI concepts like UI design are unlikely to be stressed to, let alone practised by, students (Al-Sa'di, Parry, & Carter, 2014). As a result, we are concerned that many CS students have a poor understanding of basic usability concepts, and that professors have little opportunity to teach them.

A mandatory 100 or 200-level HCI course would be beneficial in an ideal CS degree programme; however, we acknowledge that this is not always possible (especially in light of the Model Curriculum).

To that end, we present a problem-based scenario activity in which students create and test paper-based UI prototypes. The activity includes aspects of both designs (requiring reflection on HCI concepts) and implementation (through role-play that highlights how users employ these designs) in which students create and test UI prototypes (Al-Sa'di, Parry, & Carter, 2018).

Students were expected to perform the exercise during an HCI class without the use of outside materials such as textbooks or digital sources in our implementation. We imposed these limitations in order to encourage consistency and creativity, as students could only use their own knowledge and ideas. While these circumstances fitted our learning aims for the specific class (mainly due to the notion of "fit" that we discuss later in this paper), we propose that other teachers modify this exercise as appropriate.

Given the limited resources and time restrictions that many teachers experience, our activity may be utilised at any point in the CS curriculum, from Introduction to MIS to Advanced Systems Analysis and Design — everywhere students need to learn and apply usability concepts. Students do not need any prior technical abilities, such as coding or wire-framing, to

put up this project because the resources are readily available (e.g., paper and pens). As a result, the activity is widely available, and the materials are very affordable when compared to the hardware and software resources required to create a working digital prototype. This activity can be simply customised for any CS course and may be used to get K-12 children excited in computing. We describe how it was used in an introductory HCI course to underscore the significance of usability in this article.

BACKGROUND CONCEPTS

This activity is based on the Constructionist pedagogical theory. This approach, according to Papert (1991, p. 2), "boils down to asking that everything be understood by being made." The core premise is that when students create artefacts, they apply theory, concepts, and ideas in a way that is meaningful to them, making them active participants in their own learning. In other words, they construct to comprehend.

Rather of acting as a "sage on the stage," the instructor becomes a facilitator who consults, clarifies, encourages, and supports students in need through this pedagogical perspective. We provide background knowledge on paper prototyping, the concept of "fit," and a few suggested prerequisite concepts to prepare students to maximise their learning from this activity, given the shortage of HCI training in CS curriculum, and for those instructors who wish to brush up on this subject.

Paper Prototyping

Most CS professors are aware with the notion of prototypes, but they may be less so with how to put them into practise in the classroom. A prototype may be thought of as a hypothesis in the form of a rough design for a problem, which is then put to the test by how consumers interact with it (Pernice, 2016). Prototypes may be used in software development to get user feedback while also saving money since "it's 100 times cheaper to make a change before any code has been written than it is to wait until after the implementation is complete" (Nielsen, 2003, para 6).

During the 1980s, IBM promoted paper prototyping, often known as low-fidelity prototyping (Rettig, 1994) or trash prototyping (Vijayan and Raju, 2011). It is "creating prototypes on paper

and testing them with real users" in its most basic form (Rettig, 1994, p. 1). Despite their crude appearance, research has shown that the feedback they enable is of nearly equal quality and quantity to that provided by computer-based prototypes (Alkhaldi & Al-Sa'di, 2018; Sefelin, Tscheligi, and Giller, 2003). Figure 1 shows an example of a paper prototype made by one of our students as a point of reference.

Figure 1: Paper prototyping

In the classroom, paper prototyping helps students to show their comprehension of fundamental topics by creating and evaluating fast, disposable user interfaces. This technique may be used to teach excellent design ideas like usability and "fit," as well as to assess understanding of these topics (lkhaldi & Al-Sa'di, 2016). When students use paper prototyping, they create an interface, test it rapidly, and then remark on what worked and what didn't. Furthermore, using paper prototyping at various times in a lesson allows you to track students' understanding and progress throughout the semester.

Key Concepts in Human-Computer Interaction

In the field of human-computer interaction, usability is frequently characterised in terms of affordances and restrictions. Affordances are "design features of an object that imply how it should be utilised; a visual indication to its purpose and use" (Chamberlain, 2010, p.169; quoting Norman (1988)). and constraints are the "limitations of the activities that may be performed based on the appearance of the object" (Norman, 1988). For example, a keyhole's affordance is that the opening begs something to be entered; nevertheless, its limitation is that its tiny size and narrow breadth limit the range of what may be placed (Chandran, Al-Sa'di, & Ahmad, 2020). A text field on a user interface, for example, encourages the user to enter character data (affordance), although its size and meta-properties might limit input possibilities

to specific types and lengths of characters, such as a 4-digit pin number (constraint). In order to grasp "fit," students must first have a basic concept of affordances and restrictions.

Te'eni, Carey, and Zhang (2005) describe "fit" as a core notion in usability that is defined based on three distinct but connected dimensions: physical fit, cognitive fit, and affective fit. The input/output mechanics of technology in relation to human physiology are addressed by physical fit. This idea is like ergonomics and, to a lesser extent, accessibility. Physical fitness, in theory, should reduce physical effort while increasing output (Te'eni, Carey, and Zhang, 2005). Users may execute tasks successfully and efficiently when the UI and its feedback mechanisms are congruent with their past experiences, skill sets, and mental models. "The issue representation and the task both stress the same sort of information," in other words (Vessey and Galletta, 1991, p. 67). Finally, affective fit evaluates how functional (an item that a user interacts with) or non-functional (non-interactable features such as colour, typeface, etc.) UI design attributes might impact positive affect, negative affect, or another desirable emotional state (Avital and Te'eni, 2009). The purposeful design of affordances and limitations is sometimes (but not always) used to show these three sorts of "fit."

Paper prototyping, as a Constructionist exercise, allows students to experience establishing affordances and restrictions before experimenting with the many aspects of "fit." We embedded our activity's difficulty into a framework that would inspire learners to reflect, particularly on users' prospective physical, cognitive, and emotive states, to reinforce this link between the activity and the three components of "fit."

PAPER PROTOTYPING ACTIVITY

For two study semesters, we repeated this practise twice every semester (the justification for which is explained in the next section). Each execution of the exercise is designated Exercise Iteration 1 (EI1) and Exercise Iteration 2 (EI2), and each semester is designated Term 1 (T1) and Term 2 (T2) (T2). Because each iteration resulted in a paper prototype, each student received two prototypes every semester. Prototype Version 1 (PV1) and Prototype Version 2 (PV2) are the terms we use to describe these prototypes (PV2).

We began each iteration by showing a brief video of a testing session to introduce (or reintroduce) students to paper prototyping. In the video, one person interacts with the prototype

(as a user) while another manipulates bits of paper (as a computer) (Sarsam, Al-Samarraie, & Al-Sadi, 2020; Yun, 2007). The students were then given the task of designing a device interface utilising paper-based, hands-on materials. They were told there would be no grades, but they would be required to participate. The following rules were developed based on Snyder's (2001) guidelines:

• After the prototypes were completed, students were to form pairs.

• While in the "computer" role, a student presented his or her prototype to the "user"

• The "user" could click/tap on paper objects with his or her fingers while the "computer" manipulated the prototype accordingly to simulate interface behaviour

• The "user" could simulate inputting character text however they wanted (pretending to type, speaking/voice, selecting an option)

• The "computer" was not permitted to talk or make gestures indicating how to utilise the prototype; their job was limited to simulating or facilitating operation.

Students were then shown a PowerPoint slide (Figure 2) with instructions to design an urgent care check-in kiosk.

In-Class Activity

For an Urgent Care waiting room, you're building self-check-in kiosks. Patients can check in and obtain an anticipated appointment time when they arrive.

The prototype should be able to accept (but not limited to) the following inputs:

• Name, phone number, and address of residence

• Emergency contact information

• Insurance information (including billing address)

• Medical conditions and drugs taken.

The prototype must (but is not limited to) produce the following results:

• Name of the health care practitioner the patient will see

• Estimated wait time

Figure 2:In-class Activity

We found the following materials to be sufficient for our needs, however amounts may vary depending on class size: Sticky notes and/or labels, index cards (x100), no. 2 pencils with erasers (plus extra erasers), coloured pencils, scotch tape, glue sticks, paper clips, binder clips, and scissors. 11x17" cardstock paper, 8.5x11" printer paper, 3x5" notepad paper, sticky notes and/or labels, index cards (x100), no. 2 pencils with erasers (plus extra erasers), coloured pencils, scotch

Although students were not informed which materials to use to prevent accidentally influencing their designs, instructors should be aware of several typical practises. Due of its sturdiness, card stock was frequently used to portray major "screens." Sticky notes were useful for huge buttons or dialogue boxes, and scissors were useful for changing the sizes and forms of screen elements. Colored pencils helped distinguish things on the "screen" by highlighting them.

Students spent roughly 55 minutes working on their prototypes throughout the course hours in which our activities were done, during which time the teacher mediated and observed how the activity played out, helping and encouraging students as required. After that, students alternated playing the roles of computer and user with numerous peers. Each couple tested their prototypes for around five minutes before forming fresh pairings to test them again. During EI1 of T1, role-playing was restricted to the remaining class time, limiting students' ability to interact with a diverse group of peers. Prototype testing was relocated to the following class session in T2, providing for 40 to 45 minutes of testing time. The updated activity's timeframe

is summarised in Table 1. Our schedule is based on two 75-minute classes, but it may easily be changed to three 50-minute sessions.

Table 1: Lesson Schedule of Paper Prototyping Activity

Activity Steps	Approximate Duration
Class Period #1	
Step 1: Introduction Play a sample video, explain the issue, and give students time to gather materials and equipment (scissors, pencils, tape, etc.)	5-10 minutes
Step 2: Construct Prototype Students construct prototypes on their own with limited assistance from the teacher.	55-60 minutes
Step 3: Construction Wrap-Up Students finish prototypes and return toolsand unused materials	5-10 minutes
Class Period #2	
Step 4: Computer/User Roleplay Students team up with different classmates several times to play "user" (testing a peer's prototype by simulating how they would interact with a digital version of the design) and "computer" (manipulating their own prototypes based on the "user's" interaction to simulate how it would behave as a digital artefact).	40-45 minutes
Step 5: Class-Wide Discussion The instructor leads reflective discussionabout the activity	30 minutes

Students were taken through a 30-minute face-to-face conversation after role-playing to reflect on and communicate what they learned, as well as to appreciate the importance of their experience. We did not provide students access to their PV1 before or throughout the construction of PV2 to verify that they were just using their current understandings of "fit." They were, however, permitted to go through both PV1 and PV2 following the role play portion of EI2 to make sure they were well-informed enough to talk about their paper prototyping experiences.

The questions we posed to foster this dialogue are listed below. Questions 1, 2, and 5 can be asked at any time during the exercise, whereas 3 and 4 should be asked after EI2.

1. What elements affected the design of your first prototype? To put it another way, why did you create your prototype the way you did? Students frequently cite prior experiences as (at least part of) the inspiration for their work. Instructors should question students about why such designs succeeded in prior UIs and whether or not they are still relevant for this challenge.

2. Did the "usability tests," whether on your prototype or on a peer's prototype, teach you anything useful? This emphasises the importance of feedback in UI design, as students uncover beneficial methods that their classmates employed that they hadn't considered.

3. Describe any changes you made to your redesigned prototype, as well as why you made them. This stresses how information, iterative design, and assessment may help to enhance and inform "fit." The instructor should now challenge them to explain what they modified to improve the "fit" of their design.

4. Do you have any ideas for a third prototype that you didn't think of in the prior iterations? This encourages students to think about and reflect on features and functions that they were unable to implement owing to time restrictions, material limits, or other constraints (s).

5. What did you learn from this activity, if anything? This is meant to let students take a step back and consider how much significance they discovered in prototyping, design, and assessment. This encourages debate on how designer goals do not always align with user expectations, emphasising the value of prototyping and testing.

EVIDENCE

We ran two iterations of the exercise (one at the beginning and one at the conclusion of the semester) to see how much students' application (and hence assumed comprehension) of "fit"-related concepts changed. Despite the fact that this is not a research study, we have proof that paper prototyping is successful. As a result, we provide our insights from both T1 and T2 in this section, as well as synthesise pertinent student comments from focus groups and course assessments.

Instructor Observations

As predicted, the majority of the work generated for EI1 in both terms did not reflect anything about the background of the problem. Although a few students evaluated potential physical restrictions, most students did not account for the user's probable physical, psychological, or emotional states at an urgent care clinic. Despite having an injury or condition that might limit movement, most PV1s required data to be entered via touch-based devices (such as a digital

keyboard) or a mouse. A standard keyboard and mouse Meanwhile, PV1 showed some indication of affordances as functional hints (typically considered a measure of cognitive "fit").

After learning about the many forms of "fit," design concepts, and evaluation methodologies, students participated in EI2 during the last week of class. In general, pupils in PV2 showed a greater knowledge of the problem's background. Multiple kids' work demonstrated an accelerated check-in procedure, which was a considerable improvement. Users might, for example, supply important information later or request quick, emergency assistance on some prototypes. By speeding up the check-in procedure, these choices should lessen physical exertion, cognitive strain, and/or anxiety.

Another typical innovation was rapid input to reduce physical effort, such as dialogue windows for selecting nation and state (rather than having to write them out) or using an external reader to swipe one's insurance card (which would automatically populate related fields). Furthermore, students in the EI1 discussion leant significantly on prior experiences to express what affected their ideas; in the EI2 discussion, they did so as well, but were considerably more likely to frame their comments within the three dimensions of "fit."

Focus Group and Course Survey

Following EI2 of T2, a 30-minute focus group was convened during class time without the presence of the teacher to obtain honest, frank input from students to gain insight into their experiences. This was conducted by a colleague outside of the author's department in the hopes that students would feel comfortable being themselves with her.

According to one student, after taking this course,

"Every time I use any kind of technology or interface and come across something that I don't believe works or looks good, I'm going to remember what we learned and what I might do to repair it or improve it for someone, whether it's a website, an operating system, or anything else. I'll always find minor things I don't like about it now that I know how to do things correctly. So, I believe that will be the case for quite some time."

"Which activities or tasks did you think were the most beneficial or important?" they were asked. a different student replied

"Prototyping, I believed, was the most informative, especially at the beginning, because it established the tone for the session and gave us a sense of what we'd be learning about. The prototyping at the end also provided us with a concrete representation of our development and what we learnt during the course."

"Cognitive fit, affective fit, and bodily fit...," one student said when asked what they would remember about the course in five years. That is not something I believe can be easily forgotten. Because you think about those things, but now that we have the technical terminology for them and what to search for, we can really look for them."

Finally, during the first semester, students gave the course an average rating of 5.5 out of 6 (81.2 percent response rate; n=13) and 5.6 (82.4 percent response rate; n=14).

We use these end-of-semester course assessments as at least partial evidence of the exercise's utility and success. This conclusion is based on the fact that paper prototyping was the most popular exercise in class, and it was meant to incorporate all of the course's primary themes.

Although the three dimensions of "fit" were not introduced until after the EI1 (around the third week of class), the course's first few lessons focused on usability in general, with the goal of introducing basic concepts like affordance and constraint in order to establish a foundation of vocabulary for the subsequent lessons on "fit." The next 6-7 weeks were devoted to "fit," with the remaining weeks devoted to computer-assisted cooperative work, ethical design, and usability testing methodologies. The importance of "fit" was emphasised throughout these sessions.

Given that our prototyping exercise was designed to elicit designs that account for "fit," given that "fit" is a cornerstone of our HCI course and given that the exercise was used as bookends around the majority of our classes, we believe that the focus group and course evaluation results can provide complementary, albeit anecdotal, evidence to support the degree to which paper prototyping succeeded.

DISCUSSION

If you're thinking about using paper prototyping in your classroom, we have a few options that aren't included here. We begin by discussing other alternative courses in which paper prototyping may be used, followed by some basic recommendations for putting it into practise, and lastly, some extra student-oriented concerns.

Other Potential Subjects for Adaptation

Over the course of two semesters, we piloted this experiment in an Introduction to HCI elective course. Students in this class were Computer Science and/or Information Systems majors or minors. We feel that this exercise would be relatively productive in any course that touches on usability or interface design, based on the evidence of success mentioned in the preceding section and the authors' teaching skills. For example, when covering Design and Implementation as a phase in the Systems Development Life Cycle, this activity may be used in a Systems Analysis and Design course (SDLC). Prototypes, in particular, are mentioned as one design tool for assessing usability and making improvements after gathering and organising requirements in the Planning and Analysis phases (Sarsam et al., 2021; Valacich and George, 2017).

Students might be given functional and non-functional criteria and then asked to develop and test paper prototypes as part of an exercise. Not only may such an exercise help with practising and understanding usability ideas, but it could also lead to new insights on the need of clear and non-conflicting requirements documentation. Furthermore, it might emphasise that the SDLC is a unified process rather than a series of discrete phases.

A variant of this activity, for example, may be used in a Project Management (PM) course. Typical subjects in PM include SWOT analysis and feasibility evaluations, which are used to determine benefits and risks. Prototyping can be used to test the strengths and limitations of a software-based solution or as a rough draught to assess the technical (and financial) viability of building and deploying the system.

Furthermore, we feel that this exercise gives valuable knowledge that can be used throughout the whole IS curriculum, and that it might be utilised to teach HCI principles in a MIS 101

course. Students may understand that human-based interactions (such as collaborative connections, trust, and social capital (Skammelsen, Xiang, Aakarsh, & Kuppusamy, 2020; Kumar, van Dissel, and Bielli, 1998)) are typically crucial to IS design and implementation through role-playing computer and user. To put it another way, the activity might highlight the importance of contact between IT experts and end users.

Tips for instructor

Although we created and implemented our prototype exercise with the purpose of students working autonomously, we discovered that minimal teacher involvement benefited them. We propose that, while the instructor is supposed to be a facilitator, he or she does not have to be a mute observer, which is in line with Constructionism. During the creative process, students might be motivated by praise or gently critical support. Comments like "oh, you're not using coloured pencils?" or "what does this mean?" might pique students' interest or encourage them to relate the activity to course material.

In addition, the instructor's insights are useful in the discussion that follows the exercise. The teacher can find typical misconceptions or chances to discuss with the class by watching what students do during the exercise in both of the roles provided. If a crucial construct isn't seen as a design feature, for example, this might indicate that the build needs to be defined or enhanced in a following lesson or activity.

Finally, during testing times, the teacher should remind students (and correct conduct) if the rules for the roles of "computer" and "user" are not followed correctly. Because the "computer" depicts and manipulates their own design, it may be tempted to provide the "user" suggestions in the form of vocal explanations or non-verbal cues such as sighs, looks, or gestures. This is understandable since the student wants their prototype to succeed, and the functionality makes sense to them because they designed it from their own perspective.

We also didn't evaluate the activity since we wanted pupils to be as creative as possible and feel free to take risks rather than being constrained by a rubric's requirements. We believe that reminding the "computer" that this activity was not being graded helped to put them at ease and, as a result, they were less likely to provide the "user" hints.

Considering Different Contexts, Skillsets, and Tools

We asked students to construct their prototypes in class because we wanted to guarantee that (1) the materials they used were consistent, (2) they did not collaborate with others, and (3) their work was not impacted by looking for and borrowing from comparable interfaces. The final two aspects, we considered, were critical in ensuring that students' artefacts reflected their own thoughts and understandings. However, mandating in-class design work meant that students who were unable to attend those sessions missed out on the opportunity to create an artefact, and that students' work was confined (or even hurried) due to a lack of class time.

We want to allow students to create their prototypes from home in the future, despite fears that they may conspire or use unapproved resources for advice. We believe the potential advantages will exceed the drawbacks since students will have more time to dwell on the challenge and consider possible solutions, which will allow them to express their creativity and usability perspectives. We will offer explicit instructions, as with every assignment, to alleviate our anxieties as much as possible, recognising that any implementation will have its own set of perks and cons.

Each term we used the exercise, there were around 15 students, virtually all of them were Juniors and Seniors in CS or Computer Science majors, with 2 or 3 students in each class who were Sophomores or minors in the aforementioned disciplines. This group was mostly conversant with the foundations of computing technology and had no reservations about the physical needs of using paper-based materials.

However, we acknowledge that this exercise presupposes that kids are physically capable of handwriting, sketching, and paper-based craftwork. Students with physical restrictions or less comfort might design their UIs with digital tools (such as PowerPoint or wireframing software) and then produce a printout to bring to class, given our notion that prototyping could happen from home.

Regardless of the tools and limits used in this exercise, one of the primary goals of paper prototyping is to produce a valuable learning experience that is accessible to almost everyone. As a result, regardless of a priori technical abilities or expertise, we urge teachers to conduct the activity in whichever way allows them to reach the greatest possible spectrum of pupils.

Such "unplugged" activities have the potential to create democratised, meaningful opportunities for students in computing-oriented classrooms to gain knowledge across a spectrum of skill sets, expectations, and goals, regardless of major, colour, or gender.

CONCLUSION

We wrote about and remarked on our usage of a paper prototyping activity to teach the notion of "fit" in this article. While research has shown that paper prototypes can produce similar critical feedback in terms of quantity and quality to computer-based prototypes (Sefelin, Tscheligi, and Giller, 2003), there is little, if any, empirical work to guide CS instructors in using paper prototyping in the classroom to our knowledge.

We think that implementing and monitoring a paper prototyping activity across two terms of an HCI course is a realistic way for students to obtain hands-on experience applying ideas of "fit" to an artefact that can be shared and debated. Students may be more aware of the importance of people while building, deploying, and assessing information systems if they have a better grasp of "fit" and the practise of designing UIs based on that understanding. User concerns are crucial to successful and efficient interactions with hardware and software as computers becomes increasingly widespread in the industrialised world (Janicki, Cummings, and Healy, 2015)

As a result, CS curricula must continue to emphasise the importance of "fit" in successful UI design through instructional initiatives like the one described in this study.

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