Effect of digital courseware usage in a computer graphics course using the framework of instructional communication

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Abstract

*T**eaching can be viewed as a communication process when a teacher is a sender, learners are the receivers, and a message can be conveyed through several communication channels. As young learners are familiar with using computers in their spare time, digital media are increasingly being chosen to support teaching. This research aims to study how learners and teacher respond to digital media in an educational environment.*

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The research method was to observe classes and collect data related to communication components. At the end of the course, a group interview was conducted to measure satisfaction levels in several aspects such as course objectives, content, design, and usability as well as attitudes towards teacher and the course. The teacher also reported his satisfaction towards the course assisted by the digital media.

Findings showed that digital media used in a computer graphics course satisfies learners to a high degree and enhances learning outcomes significantly. However, the usability of e-learning websites does not satisfy the learners as much as other aspects. Effective interpersonal communication among students and teacher is still considered indispensable to create overall teaching success. Knowledge and teaching experience remain key factors in designing a course. Finally, the amount of effort required to develop a course can be a deterrent when trying to incorporate such potential media.

Introduction

One of the most significant current discussions in the media and communications field is how communicators can make the most use of the computer and the Internet. The past decade has seen the rapid development of digital media used in many aspects of our daily lives. In many parts of the world, without computer skills, younger generations are finding it increasingly difficult to compete with their peers.

Educators, therefore, should ensure that their students know how to use the latest technologies constructively by incorporating these advancements into their classes. However, they face the problem of how to design such coursees. Questions have been raised about the use of the technology in an educational environment where both teachers and learners can benefit. The aim of this study is to see how learners and their teacher react to digital media used in a course.

Literature Review

As a starting point to answer the research question, this paper has reviewed the following areas: Instructional Communication, Backward Design, Computer/Internet usage among Thai youth, Media and Communication channels, Digital Course Wares, Diffusion of Innovation, Learning Outcome, and Media uses and gratification.

Instructional Communication

While a variety of definitions for the term instructional communication have been suggested, this paper will use the definition suggested by Thompson (1969) who saw it as a process in which teachers convey teaching content to learners in order to make them understand the subject being taught. The instruction can be considered as a communication process where its components, including sender, receiver, message, and medium, can serve as an analogy as follows. The teacher plays a sender's role which requires him or her to encode the teaching content, as message, to fit with chosen communication channels. The communication objective is to make the students, as receivers, understand and be able to do assignments correctly. Changes in cognitive and behavioral attitudes towards the course, instructors, and learning outcome, are all considered as feedback from the receiver.

It is also important to emphasize that the instructional communication process is not linear, but circular :

Communication is not a linear process; it is circular, or cyclical. Information passes from the sender through the receiver and then back to the sender in changed form-thus completing a cycle (Thompson, 1969, p.4-5).

Unfavorable outcomes and feedbacks can occur because of obstacles such as verbalism, day dreaming, referent confusion, limited perception, physical discomfort, and imperceptions. Oral or verbal, nonverbal, and visual communication needs to be used in instruction effectively to limit the unfavorable outcomes.

Backward Design

Wiggins and McTighe (2005) define backward design as the principles of course design by identifying desired results, then using indicators and evaluation to determine learning activities, and finally planning learning experience and instruction. Unlikely ordinary course design which usually places indicators and evaluation at the end of the design process, backward design takes the final parts of the process into consideration to help the teacher plan each learning activity more logically. This is to ensure that each of the activities in the course leads to the designated outcomes without digression. It is important that the course designer set the outcomes that meet both the student's expectations and the academic standards.

The teacher needs to consider what background the outcomes are based on, what students are supposed to know and do, what is valuable, and what should be used to inform students. Acceptable evidence, for example, a series of tests and hands-on projects, can serve as proof of performance and changes as a result of the instruction. Learning experience and instruction, including lectures,

exercises, tasks, teaching materials, devices, and method, have to be carefully planned and chosen so that the learners will have enough support for the development of understanding, interest, and excellence in the subject. Therefore, the backward design process starts with identifying desired outcomes, followed by determining acceptable evidence, and finally, planning learning experience and instruction.

Computer/Internet usage among Thai youth

According to a survey by Thailand's National Statistics Office (2008a, p. 2), 28.2 percent of the national population of 60.3 million persons use computers, and 18.2 percent are Internet users. The number of computers and Internet connections per 100 households is 24.8 and 8.6 respectively. These numbers have been increasing by almost 10 percent every year since 2004.

Half (55.6%) of population aged 5-24 are computer users. It is important to mention that most (82.6%) of teenagers aged 11-17 are computer users (National Statistical Office, 2008b, p.xxi). This might be result from the very large number (86.5%) of parents who support their children's use of computers. (National Electronics and Computer Technology, 2005). However, 57% of these parents are worried about their children's use of the Internet, many of whose children use computers/Internet at internet cafés for gaming either online or offline. Those who responded positively about their children's use of the Internet reported that their children use the computer/Internet for educational purposes or information gathering (surfing) at home and educational institutes.

Media and Communication Channels

As a sender, a teacher has to choose the best possible communication channels to ensure the best outcome. The instructional media they use can be categorized into three groups: material or software, device or hardware, and technique or method (Dale Edgar, 1965).

Materials can be self-contained sources of information such as books, models, pictures, and charts, or the source of information required to open and operate other devices, like microfilms, documentary TV programs, CD-Rom, and computer-based lessons. Devices are tools conveying and disseminating knowledge to learners such as televisions, radios, projectors, and computers. Techniques can be the experiences in which the learners engage, for example, demonstration, role play, study trip, exhibition and styles used to deliver the teaching content..

That instructional media play important roles in the learning process and that both instructors and learners benefit from these have been well established (Malitong, 1993, p.83; Sang-ong 1983, p.15; Rasamee-prom 1988, p.21). These allow instructors to have more time to prepare a wider variety of learning experiences to arouse learner's responses add more information to the class. Moreover, students can also use the media in their preferred time, at their own pace, and, most importantly, at their home where the instructor is not available to respond to a learner's inquiry.

Brown (1985 as cited in Malitong, 1993: 90) suggests that after the teacher decides what media to use, he or she should get prepared by reading or listening to the selected the media to check if it is correct, complete and meets the objectives. Then, they must prepare the environment, which is usually a classroom, and necessary devices. Learners have to be prepared to ensure that they are ready to take in the new information. This can be done by informing the learners about key concepts or how to use instructional media. During the class, it is important for the instructors to use the media at the right time or as planned to ensure the smooth delivery of instruction. Feedback can help the teacher improve the learning activities.

Digital Coursewares

Digital coursewares are the digital media used in an educational environment. These can be viewed in three dimensions: content, application, and users.

There are three levels of content. The first level is the courseware dominated by text, or so-called text-online. A higher level is a courseware that offers interactivity, including text, hypertext links, video clips, and sound clips. When the interactive online course has been developed by a more professional team, comprising a graphic designer, content provider and designer, it will reach the highest level, the so-called high quality online course.

The digital media can be used as supplementary or complementary material to traditional teaching methods, or even as a comprehensive replacement. First and foremost, though, it will be used as one of many alternatives for information.

The second application is digital media that is designed for learners to be used outside of the classroom. This type of courseware requires a more careful course design so that it will not interfere with the main learning activities. The comprehensive replacement requires learners to depend mainly on the media rather than traditional instructors. The

learners have the least opportunities to interact with the instruction. Production of the courseware for complete replacement needs meticulous course design and a sufficient amount of media testing to ensure its effectiveness.

Courseware users can be divided into two main categories. Resident students refer to students who have agreed to go to class. The media, therefore, needs to be adequately attractive, or the students might prefer other means of learning. The other group is the distant learners. This group can access the media at different places and times. As they are afforded limited chance to interact with the teacher, it is essential that the media and the course are very well thought out and designed.

Diffusion of Innovation

According to Rogers (1995), innovation can be ideas, actions, or things that people consider as novelty or that are recently discovered. It also depend on an individual's judgment whether such ideas, actions, or things are new to him or her. Malithong (1993) added that modification and adjustment of existing ideas, products, or procedures can result in innovation as long as the modifications are more effective, efficient, and productive.

Four key components are involved in the process of innovation diffusion: innovation, communication channel, time, and adopter (Rogers, 1995). In this case, innovation is the use of digital media in an educational environment as well as the course, designed under the instructional communication and backward design concepts. When a teacher develops a course and tells the learners to use it, the communication activities have begun. The learners sometimes need to evaluate the options and decide whether to adopt either or

not. The length of time spent to decide to adopt is shortest for the innovator who loves trying new things, followed by early adopters, early majority, late majority, and laggards. Those who do not adopt the innovation are described by Rogers as "die-hard". When the innovation is later compulsory in a society, this latter group will be considered as laggard.

Learning Outcomes

The results from knowledge, skills, and competencies developed by instruction are referred to as learning outcomes. They can show noticeable changes in knowledge, attitudes, and practices.

Changes in knowledge can be measured by a test containing questions that requires an answer from information provided during the course. The questions can ask directly for information learnt from instructors or test if the student knows how to apply the information. In addition to test results, Mottet, Richmond, & McCroskey (2006) suggested that attitudes be measured as learning outcomes. The measurements can be done by having an observer fill out a form indicating the frequency of particular behaviors, or by having students fill out an self-evaluation form or participate in an interview. A self-written report that reflects how the learner feels can also be used for measurement. The practices or skills can also be measured by observing how skillful and confident the students are when asked to perform hands-on assignments.

Uses and Gratification

Numerous studies have attempted to explain people's media uses and their gratification towards it (Katz, Blumber, & Gurevitch, 1974; Rosengren, 1985; McCombs and Becker, 1979; Sirigaya and

Kaewthep, 1988). The common explanation of people deciding to choose to use a particular medium/or media is their needs. These needs can be the needs of information to help make an informed decision, the needs to reinforce identity, the needs to socialize with others, and the needs to be entertained.

Individuals usually assess the ability of particular medium to satisfy their needs, called the expectation leading to exposure to, or use of the chosen media. Then, individuals can evaluate the result of the exposure. If the result is better than the expectation, they will be satisfied with the media. If the result is worse than the expectation or creates other unfavorable consequences, they are likely to avoid the use of this media in the future.

Methodology

A variety of methods are used to assess how learners and their teacher react to digital media used in a course. One is the observation of the classes by using adapted instruments suggested by Mottet et al (2006). An observer rates the frequency of occurrences and describes student gestures indicating eagerness to use the digital media and learn the subject as well as the learning atmosphere in the class.

At the end of the course, a moderator interviewed the students using the evaluation guidelines suggested by Gillis (2000). This is designed to gather data concerning learners' reaction, attitudes, and satisfaction to digital media.

Then, the teacher's self-report covers the instructor's feelings and activities during the media preparation, production, implementation, and evaluation.

Comparison of the quality of assignments between the groups, using and not using the media, was used to measures the effectiveness to change levels of knowledge and skills. Three examiners with at least three years experience teaching graphic design were assigned to mark the students' assignments without knowing which assignments were the products from students in the digital-media-assisted group. The examiners also did not know each other and worked at different times and places. Each used the same. evaluation forms which included detailed explanations of each criterion to ensure the consistency of scores given by the different examiners.

The login trackers equipped with the courseware would be used to record time and frequency of the students' ccess to the courseware.

A computer graphic course was chosen as the experimental sample because it was the most relevant to digital media, and was conducted in the computer labs, where the teacher's and learners' reactions could be observed. The number of student enrolled was nineteen, which is a manageable size for focus group interviews. They were informed at the first session that this course was part of an experiment, and they were allowed to choose not to participate.

Result

To assess teacher and learner reactions to the computer-assisted communication, observation, teacher self-report, comparison of outputs, student group interviews, and automatic access records were used.

Class observation

After six four-hour sessions, the observer reported that the students were keen to use the

media to help their learning in the first few sessions; then the eagerness seemed to decline. When shown any video clip longer than 5 minutes, some students' concentration clearly decreased. Digital media sometimes distracts students from lectures leading to asking the teacher to repeat instructions. Over time, it was found that the students could use the website more skillfully than in their first few sessions.

The instructor conducted his class in relaxing atmosphere and used positive non-verbal cues such as friendly facial expression, open hands and arms, energetic voice, and good eye contact.

Overall, the atmosphere of the class was good for students to ask questions and interrupt when he or she could not follow. The students paused and replayed video clips when they needed. The teacher could give students feedback on their assignments and taught some special techniques required for some individual design projects.

Self-report

The teacher's self report indicates that preparation of the media for six sessions took a very long time to complete. The teacher felt grateful for an adequate grant , which allowed him to hire two part-time research assistants, and, fortunately, one of them was a postgraduate student, majoring in art education.

The teacher reported that it took more than 100 hours for preparation, most of which was spent preparing teaching materials with credible sources. Scriptwriting of sixteen clips required a lot of creativity as well as time. Moreover, it took almost 50 hours to record the fifteen demonstration videos and change file formats.

It took around one week to finish shooting the video clips for the theoretical part of the course. A crew of 5 postgraduates, majoring in filming, was hired. The living room of the teacher's apartment was turned to a shooting studio. The crew slept in the apartment for several nights. After editing, some misspelling was found in the clips, but the teacher felt hesitant to call for reshooting.

Another 10 hours was dedicated to organizing and putting all the video clips and the online tests onto Blackboard, the courseware system that Chulalongkorn University has introduced.

During the class, the learners' eagerness to see the clips made the effort and time worthwhile. The misspelled words had to be corrected orally, even if no students noticed the errors.

When the teacher saw the assignments and compared them with the control group that studied without the digital media, he found that the quality of the assignments was more consistent. It should be noted that there were no obviously weak students in the course with digital media. The number of phone calls to the lectures' personal mobile phone to ask how to do the assignments droped dramatically from the previous years.

Comparison of output

On average, the scores of groups using digital media were higher than those of groups not using the digital media (see Table 1). The greatest differences are found in the last assignments, which required students to design a corporate identity. This assignment is assigned in the last lecturing sessions after the students have been exposed to the digital media for six weeks. This type of design requires a higher level of knowledge and skills in design than the previous assignments.

Tables 1: The scores given by examiners

Week	Assignments	With media	Without media	Differences
1	Animal	3.81	3.27	0.54
3	Retouch	4.21	3.71	0.50
4	Logo	3.10	2.53	0.57
4	Thematic stationary	3.01	2.14	0.87
5	Brochure	3.25	2.98	0.27
6	Logo for corporate identity	3.39	2.58	0.81
6	Corporate Identity (Overall)	3.94	2.69	1.25
Total (35)		24.71	19.90	4.81
Total (percent)		70.60	56.86	13.74

The least significant differences are found in the assignment requiring the students to design brochures. The examiners commented that they could not see and give marks to the brochures assignment as accurately as other assignments due to the small size of printouts (4x6 photo paper).

Comparing the total scores, it was found that the group using digital media obtains 13.74 (19.5%) higher total scores than the other group. After removing the brochure assignment, an increasing trend of difference can be seen: 0.54, 0.52, 0.57, 0.87, 0.81 and 1.25, as assignments became more difficult or complex.

Student Group Interview

As shown in Table 2, during the interview, the topics discussed were usability and course design.

The positive feedback was that usability was due to easy access and no requirements to install a plug-in. Moreover, the consistent appearance and page layout made the structure more easily understood. Most students responded favorably to teaching steps as well as visual and audio cues used in the video clips.

The students also found this teaching method encouraged them to apply their gained knowledge better thanks to a better understanding of content taught; furthermore, the hands-on assignments were also relevant to content taught. The IT department could give them support if needed. They could learn at their own pace, pausing or replaying as many times as they liked. For fast learners, they could move on to the next assignments and could be individually trained more advanced techniques by the lecturer. The teacher is perceived as very attentive and inspiring, and the content is felt to be easier to take in. Most of the students expressed high satisfaction with materials used and learning activities in the course.

On the other hand, the instruction of how to use the courseware was said to be inadequate. Students also complained that they incurred additional costs as they had to pay and Internet connection fee to an Internet service provider if they wanted to have access to the courseware at home. Moreover, the interface was old-fashioned and unattractive to them.

There is some room to improve the video clips, as the students said that they prefer to see more examples in video clips in order to better understand the topic discussed. Technical problems such as large file size or file formats caused frustration sometimes. Most students stated that when they had a question, they preferred to ask the instructor in the class rather than leave an email or a message. No negative attitudes towards the teacher or methods of instruction were mentioned about the teacher or control.

Table 2: Student Group Interview

| Topics	Attitude and Satisfaction	
	Positive	Negative
Usability		
Technical issues	Easy to access Few Plug-in to install	Little instruction to use Cost of internet connections
User interface	High level of consistency and good organization Understandable interface	Too simple, old fashioned and unattractive Small typeface
Course design		
Teacher	Very attentive, inspiring	N/A
Presentation	Good order in teaching steps Good use of animation, graphics, sounds, and effects Make things easier to take in	More examples required Sound is difficult to hear in some video clips Lighting is too dark.
Teaching Method	Encouraging application of knowledge acquired	Preferred to interact with lecturer in person rather than through the courseware
Hands-on assignments	Very relevant to lecture and real world application Adequate number of assignments	N/A

Topics	Attitude and Satisfaction	
	Positive	Negative
Support	IT department is supportive and helpful	Most students are not aware that their usage is being recorded and monitored
Control	Self-pace learning Sense of freedom to learn	N/A

Access records

The figures show the accumulative number of access to the courseware by hour of day and day of week. It was found that the courseware was not accessed between 2 am.-6.30 am. The busiest access took place during the early afternoon with 1,200 hits. This number then decreased to 200 hits at 9 pm, rose back to 700 hits at midnight, and finally before dropped to nearly zero at 2 am. It was also found that the day of week that the courseware is accessed most frequently is Wednesday (3,500 hits), followed by Monday (2,500 hits), Thursday and Tuesday, which obtained a similar access number at 1700 hits. This could be because the course was taught on Wednesday afternoons, and students would either rush to complete the work before class or be highly motivated to continue with their studies in the same evening. Monday could show access as students continue their project after the weekend, while Tuesday and Thursday showed the least hits, even though they were still substantial, as the students prepared for other classes on Tuesdays and felt on Thursdays that they still had time still to complete their assignments.

Figure 3: Access records in Hour of day and Day of week.
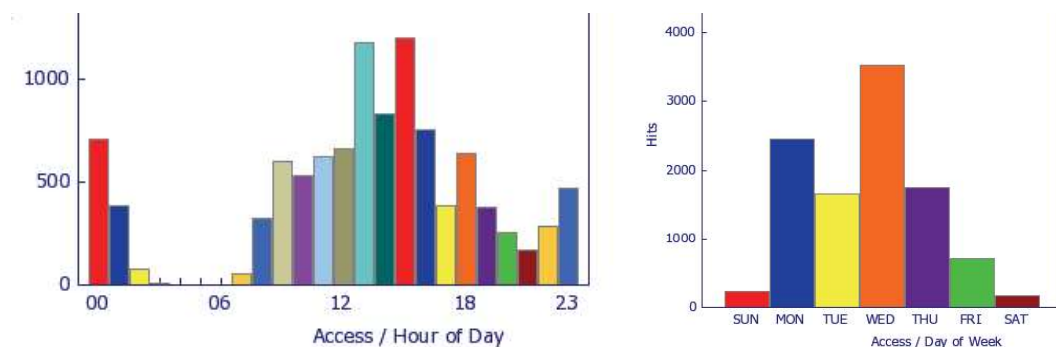
Discussion

As mentioned in the literature review, instruction is a process similar to communication. The senders and the receivers exchange meaning via communication channels, including, in this case, person and digital media (Thompson, 1969; Mottet, Richmond, & McCroskey, 2006). The strong relationship between outcomes and the ways the process works has been emphasized by Wiggins and McTighe (2005). This study, therefore, set out with the aim of assessing the reaction of the teacher and learners in the use of digital media for educational purposes.

Reaction from teacher

This study supports previous research into gratification which links uses and consequences (Katz et al, 1974; Rosengren, 1985; McCombs and Becker, 1979; Sirigaya and Kaewthep, 1988). At first, the teacher found creating a courseware was a very time-consuming task. However, when this media demonstrated its benefits, the teacher felt the time and effort paid off , particularly when less time is required for preparation for different groups of students, and this meant he felt less stressful in the classroom. The gratification is perceived by the positive consequences. It is likely that the teacher would utilize the digital media in the future if a team of teacher assistants is provided for production of such materials.

Moreover, he felt good when he could concentrate on assisting, answering, and giving feedback to his students. This is consistent with the observer report about positive non-verbal cues indicating the teacher's reduced concern about demonstration and having more opportunities to interact with learners individually. The assistance

of media might be the reason for the affective and positive behavioral reactions in the class. This finding is in agreement with Wiggins and McTighe (2005) who showed that backward design could help a teacher plan teaching methods that lead to the desired outcomes.

In terms of diffusion of innovation, although using digital media in educational purposes is not new, the use of such media at the university level, especially in the course provided for this experiment, is still in its infancy. The teacher, therefore, could be considered as an early adopter who has to struggle to find the balanced use of digital media and needs more support from the innovation promoter (Rogers, 1995), which is in this case is the university administration.

Reaction from learners

This study produced results that corroborate the findings of a great deal of the previous work in this field (Malitong, 1993; Sang-ong, 1983; Rasamee-prom, 1988). It showed that almost all students gave positive feedback about the course assisted by the digital media and use the out of class hours, when the class was taught on Wednesday between 1 pm. to 4 pm. This record clearly indicates that the learners use the courseware at home, learn at their own pace, and might use courseware to help them do homework or revise techniques taught.

The courseware produced by following Wiggings and McTighe (2005)'s backward design process might be the reason why the learners found the assignments and lectures relevant to what would be required to develop the necessary skills to complete their final projects.

However, the technical problems and appearance of the courseware did not meet their

expectations as much as its presentation and organization. It seems possible that they use the appearance of gaming or entertainment websites as their benchmarks to evaluate the courseware.

Students' lack of negative attitudes towards the teacher might be of the result of their concern of receiving a poor evaluation later, as the group interview took place one week before the final exam. Therefore, these results need to be interpreted with caution. However, when considering all the feedback, the students did have a high regard towards teacher rather than the media. This might be caused by the teacher feeling more relaxed when he did not need to focus on live presentation as much as when conducting a class without the assistance of digital media.

Overall

The digital media can help students learn better, especially when they are hard working and motivated to review and practice on their own. The time spent on the courseware could be a major factor, if not the only one, that caused the increasing differences between the sample and control groups. Thus, it can be assumed that courseware can work every well with courses requiring students to practice on their own and to stay interested in a course for an extended period of time, in this case, six weeks. On the other hand, the teacher would feel satisfied if the courseware can be used several times with different groups of students.

Limitation

The nature of the course offers an unusual chance to use digital media. In terms of teaching infrastructure, the course took place in a computer lab with full support from the university IT

department. Financially, the production of courseware was fully funded as an integral part of the research project. Personality of the teacher may also affect the attitude towards the course. The lecturer in this course is comparatively much younger than other lecturers in the institute. He generally has a good sense of humor and possesses a relatively strong background in communication. More importantly, this research paper has been written by the lecturer, himself. With a small sample size and untypical context, caution must be applied, as the findings might not be transferable to other types of courses, students, and teachers.

Implications

This combination of findings provides some support for the conceptual promise that the digital media used in courses aimed at university students can enhance learning outcomes. Increased opportunity to communicate to students is likely to create a positive attitude towards a teacher as a sender. The teacher will also feel less tired as he or she does not have to juggle teaching activities such as demonstrations, answering questions, helping slower learners, and pushing fast learners forward.

Although the teacher in this study reported that there are misspelled words in some of the video clips, only a few of the students could notice them, and none found them severe. On the other hand, the students appreciated the teacher's sincerity when he dared to let the students know his mistakes and corrected them openly in the class.

One of the issues emerging from this finding relates specifically to costs of the courseware in terms of time, effort, and, of course, funds. The university administration needs to find ways to

encourage more teachers to design courseware as the findings from this research as well as several others show positive responses from students. Therefore, there is no doubt in the benefits offered by well-planned courseware.

Recommendation

More research on this topic needs to be undertaken before the association between attitude towards the courseware and attitude towards the teacher is more clearly understood. In the future, investigations might compare the result among teachers with different traits of personality or with different levels of communication skills, or among courses with different levels of computer relevancy.

The findings suggest several courses of action for teachers, university administrations, and IT departments. For teachers, adoption of new teaching technology could make their teaching experience more enjoyable in a long run despite the large amount of time and effort required initially. The university administrations should give faculty members adequate funding, equipment, staff, consultancy, and even incentives to increase application of digital courseware . As IT departments control the appearance of courseware, the findings clearly show that this department should consider improving courseware appearance to attract students more. Research on student online surfing behavior could be of assistance for the designer to develop appropriate design solutions.

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