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# Access to on-line learning: a SAD case

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## Abstract

As evident through recent litigation, Institutions of Higher Education are increasingly being held accountable for the federal mandates on ensuring equivalent access to online education for students with disabilities. This has strong implications for incorporating strategies to enhance accessibility and universal design into all courses from the beginning stages of development. The responsibility for this lies primarily with the Faculty Instructors and Instructional Designers. This Case Study demonstrates how the accessibility of an Information Systems course was improved through development as a fully online course.

**Keywords:** online, universal design, accessibility, information systems management, instructional design

## 1. INTRODUCTION

Recent events have highlighted the need for institutions of higher education to be better prepared to address emerging accessibility issues and expectations as teaching and learning migrates from the face-to-face environment of the classroom to the more virtual settings offered by on-line and blended courses. Such migration requires attention, not only to accessibility requirements, but also to accessibility *expectations* and *opportunities* - particularly in regard to online classes and the various aspects of information and instructional technology that support their development and delivery. A 2012 case brought by the National Federation for the Blind (NFB) against Pennsylvania State University (PSU) highlights the emphasis on compliance with 'requirements' and resulted in a settlement agreement that obliges PSU to meet accessibility compliance standards in a number of disparate areas by August 2014: they include the PSU learning

management system, university websites, information technology, classroom technology, library services and technology procurement. Similar charges have been filed against Northwestern University, New York University, the California Community College System and Florida State University.

With advances in assistive technologies, students with disabilities now have improved opportunity to pursue higher education. This is a welcome trend that is facilitated by these technologies: the information systems discipline has provided tools that expand access to teaching and learning beyond the physical classroom setting - and beyond the bounds of its own programs. At our institution, we have observed increases in enrollment in the IS major and other programs by students with vision, hearing, learning, and physical disabilities, each of whom present individual and unique learning and technology access needs. These individual needs present a growing range and volume of

challenges as the number of students rises and the diversity of their needs expands. However, they also present an opportunity to explore the technologies themselves and how they might be more fully exploited to meet the learning needs of the whole, and increasingly diverse, student population.

Due the nature of delivery of online courses, Web Accessibility becomes a key component to online course design; however, federal legislation, such as section 504 and 508 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act, does not outline specific accessibility standards or metrics for online or blended learning. The cases above make it clear that equal access includes online education – despite the fact that the regulations themselves predate the emergence of the (worldwide) web by 20 some years.

The issues and shortcomings that gave rise to these cases provide the basis to reflect on the strengths and limitations of regulations and other guidelines. That reflection prompts three complementary aims

- To identify gaps and overlaps in existing regulations and guidelines and propose a more cohesive framework more conducive to the development, delivery and assessment of courses in both traditional and non-classroom settings.
- To consider the teaching, learning and assessment challenges that emerge as the range of courses delivered in non-classroom settings expands to include those whose learning outcomes are more complex and 'multi-dimensional.'
- To articulate a shared design process in which faculty and instructional designers proactively explore and exploit opportunities to optimize accessibility for all.

Our experience shows how accessibility can be repositioned: rather than the basis for a 'checklist' of minimum requirements to ensure compliance with the law and other regulations, we see accessibility as an agenda. Rather than reacting to shortcomings and limitations and retrospectively addressing the needs of individual students with disabilities, course design can be driven by the opportunity to maximize accessibility for all students, whose learning abilities span an ever increasing range.

The following section considers the emergence of accessibility issues: the brief review of the literature highlights the universal emphasis on legislative compliance. It also highlights the particular challenges presented by courses that endeavor to teach design. The third section articulates these challenges for a particular course and provides an overview of the institution where the research and design were conducted; the fourth section describes the process that we developed to address these challenges and the penultimate section reports the outcomes of our initiative. The paper concludes with observations and recommendations for further research and development of best practice.

## 2. PRIOR RESEARCH

In this section we review prior work on accessibility and place it into the context of the teaching and learning challenges and opportunities that on-line course delivery offers. Our review of the literature narrows to focus on the challenges specific to one of the core courses in the undergraduate information systems curriculum (Topi et al, 2010).

Prior research on accessibility has focused primarily on the effects that technological advances in web design have had on accessibility for persons with disabilities. Sloan et al (2002) were commissioned to audit (sic) the accessibility of 11 web sites in the UK higher education sector. The design of this study – an *audit* – is itself revelatory: an *ex post* analysis of impacts that assumes technology to be the 'independent variable'.

The studies by Kim-Rupnow and Burgstahl (2004) and Hackett and Parmanto (2005) place similar emphasis on impacts and outcomes of technology use – a familiar emphasis in the information systems discipline (Bhattacharjee, 2001; Roca et al, 2006). The emphasis on outcomes is reinforced by the research designs that focus on longer-term impacts of the internet and other technologies for students with specific disabilities (Smith and Lind, 2010) and those transitioning into or through further and higher education (Hackett and Parmanto, 2005). The longitudinal emphasis is welcomed, as is the acknowledgement of skills as legitimate and important learning outcome in higher education. Nevertheless, there is a strong sense of technological determinism: prior research tends to focus either on compliance with regulatory

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change or on the acceptance of emerging information systems.

The focus on specific disabilities rather than the range of abilities in a normally distributed population of students – when combined with the *ex post* emphasis of audit and other research into the acceptance of given technologies tends to narrow the research agenda to reaction to technological change. It is our contention that ‘design’ in education is not as universal as Burgstahl and Cory (2008) propose. Accessibility is not just about students with ‘disabilities’. Each of us have some limits to our ability when it comes to the rapidly evolving conceptual design challenges that contemporary information systems present (Hevner et al, 2004).

In an era when much emphasis is being placed on Science, Technology, Engineering and Mathematics (STEM) education, it is pertinent to reflect on the centrality and complexity of design in information systems. The complexity and conceptual richness of the design artifacts and process central to information systems is particularly evident in the Systems Analysis and Design (SAD) course (Avison and Fitzgerald, 2006; Topi et al, 2010) where students are first introduced to them.

Systems Analysis and Design is the gateway to undergraduate Information Systems programs. The concepts learned here are an essential prerequisite for successful completion of the major: they are also essential for mastery of the language, tools and techniques that enable their effective use in employment (Yourdon, 1993). The primary learning goal is mastery of a range of modeling techniques and their use as the basis for effective communication between user communities engaged in a particular business and the developers and programmers who build information systems to support the business. The course content is – and always has been – conceptually complex (Avison and Fitzgerald, 2006). This complexity has been compounded by the succession of (traditional) structured analysis and design methods, tools and techniques. The emergence of object-oriented analysis and design methods (Yourdon and Coad, 1991) presents a further cognitive challenge to both teachers and learners.

Object orientation represents a migration of the engineering and mathematics-dominated mind and tool sets that have prevailed since they

emerged in the 1970s. Research has shown that structured methods act as a ‘comfort blanket’ (Fuller and Davis, 2008) and guide the cognitive sense making processes used during analysis and design. Such cognitive inertia can become a potential barrier to learning among both mature (post-experience) students and ‘beginning’ IS majors. The frames of reference for articulating business requirements provided by structured and object oriented methods are fundamentally different. The more holistic, systems science basis of object oriented techniques provide very different communication ‘channels’ (Fuller and Davis, 2008) and ways to ‘make sense’ of business scenarios. This, in turn, radically alters the skill set needed to effectively use them.

The specific cognitive mechanisms underpinning sense making are beyond the scope of this paper. Interested readers might care to review the proposals put forward by Hevner et al (2013). However, the process of making sense is pertinent to the design, development and delivery of the Systems Analysis and Design course.

In addition to the concepts underpinning object oriented analysis and design tools and techniques such as Activity Diagrams and Behavioral State Machines, students are also introduced to the industry standard Universal Modeling Language (Rumbaugh et al, 2004) that is used to develop them. UML is taught using industry standard symbol sets and templates in Microsoft’s Visio software suite. Thus the ‘content’ of the course and its learning outcomes comprise a tightly integrated mixture of cognate material and technical skills. The Systems Analysis and Design course is characterized by the ‘multi dimensionality’ of its learning outcomes.

Early on in the development of the on-line version of the course, accessibility loomed large as a factor critical to the success of the students. Unless they could ‘access’ the conceptual underpinnings of object orientation, they would be unable to effectively develop and share the various models that comprise the UML. Thus the access challenge is faced by students with a range of abilities, spanning mature, working students with decades of experience with structured methods, students new to the IS discipline as well as those with more specific disabilities.

Wallace (2003) identifies communication and interaction between students and instructors central to coaching the migration of mind and tool sets 'into' object orientation. This point is reinforced in the wide-ranging survey by Collins and van der Wende (2002): instructors who emphasized the delivery of content on-line found that there is 'not much in it' (on-line course delivery) for instructors. The need to coach the development of modeling skills persists, prompting many to abandon efforts to move to on-line and blended instructional methods and giving rise to instructional design inertia.

Such inertia is acknowledged by Kelly et al (2004), who note that the accessibility of e-learning presents additional challenges that may not be faced when providing access to other Web resources. We concur with their arguments that there is a need for a more sophisticated model for addressing e-learning accessibility which takes into account the usability of e-learning, pedagogic issues and student learning styles in addition to the cognitive issues discussed above and technical and resource issues. In the sections that follow we expand on these issues and propose a collaborative, holistic approach to the development of accessible e-learning resources through the application of the Quality Matters Accessibility Standard.

### 3. THE RESEARCH SETTING

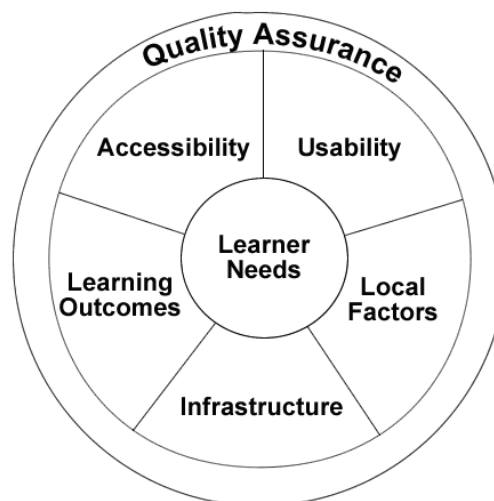
The University of South Florida St. Petersburg (USFSP) offers a range of distinctive graduate and undergraduate programs in the arts and sciences, business, and education within a close-knit, student-centered learning community that welcomes individuals from the region, state, nation and world. We conduct wide-ranging, collaborative research to meet society's needs and engage in service projects and partnerships to enhance the university and community's social, economic and intellectual life. As an integral and complementary part of a multi-institutional system, USF St. Petersburg retains a separate identity and mission while contributing to and benefiting from the associations, cooperation, and shared resources of a premier national research university. The university's online learning is delivered through a learning management system; Canvas by Instructure.

The recent adoption of Quality Matters (Quality Matters, 2013), an online course quality management program, at USFSP has provided a

set of specific standards that can be used to enhance the accessibility of courses. Quality Matters is a quality assurance program that facilitates a peer review process to recognize courses that follow best practices for design and promote student success in online education. Courses are reviewed using a rubric (Quality Matters, 2011) comprising a set of eight research-based standards for design, one of which is Accessibility.

### 4. THE COURSE DEVELOPMENT PROCESS

Kelly et al (2004) propose a conceptual model that advocates a holistic approach to e-learning accessibility. Figure 1 shows the conceptual structure they propose.



**Figure 1** Holistic e-learning accessibility (after Kelly et al, 2004)

Within an encompassing emphasis on quality assurance, a number of course design, delivery and assessment criteria are identified. It is noteworthy that learner needs are central to the model: it is highly 'student centric'. It is also noteworthy that accessibility is given equal weight and prominence to aspects of course design that elsewhere tend to dominate.

Here, accessibility is seen as an equal and integral part of design and delivery as learning outcomes, technology infrastructure, usability and other factors. This multi-dimensional view of quality assurance provided a frame of reference for our efforts to operationalize the model – to

balance emphasis on accessibility with other aspects of course design - as we considered the tools, techniques, standards and other guidelines available to us.

Quality Matters Standard 8 focuses on the Accessibility of online courses. "The accessibility standard incorporates the principles of Universal Design for Learning and is consistent with Web Content Accessibility Guidelines (WCAG)" (Quality Matters, 2011). Standard 8 encompasses four specific criteria that broadly outline the degree to which a course should be measured as accessible which includes employment of accessible technologies, guidance on how to obtain accommodation, alternatives to audio visual content, distraction reduced design, and compatibility with assistive technologies. Note that only the final criterion is 'limited' to those with specific disabilities.

As stated previously, we saw a holistic approach to accessibility as an agenda, and so throughout the development process, we used both sets of guidelines that QM Standard 8 is based on, UDI and WCAG, but in a pro-active manner, rather than merely 'following' them. We explored their complementarity as a means to fulfill their true intent and achieve the most technologically and pedagogically cohesive and accessible course possible.

Universal Design for Instruction (UDI) is a set of pedagogical principles that operate under the principle that, if you structure the curriculum with the appropriate supports and challenges, all students can learn (Scott et al, 2003) regardless of disability, age, gender, ethnicity, or other characteristics that might affect their learning. Dukes and Scott (2009) and the UDI Online Project at the University of Connecticut outline nine principles for achieving universally designed instruction for online and blended courses. The nine principles include equitable use, flexibility in use, simple and intuitive, perceptible information, tolerance for error, low physical effort, size and space for approach and use, a community of learners, instructional climate.

To better illustrate the UDI applications to the course design, the simple and intuitive principle can be seen in the course and module navigation. Upon entering the course, students encounter the home page which provides step-by-step instructions to orient themselves to the course and get started on the material: the left course navigation menu is reduced to display

only the essential navigation options. This page and navigation structure is applied consistently in every course module. This element of our design benefits students who may have learning or processing disorders (visual and auditory); those who could be easily distracted by extraneous information; students who have physical impairments and may be using alternative computer access technologies for navigation, as well as students who have impaired vision and use screen reading technology to navigate the course. In addition to supporting this specific set of students with disabilities, streamlined navigation improves the usability and accessibility of the course for all students. Figure 2 shows the streamlined course and module navigation.

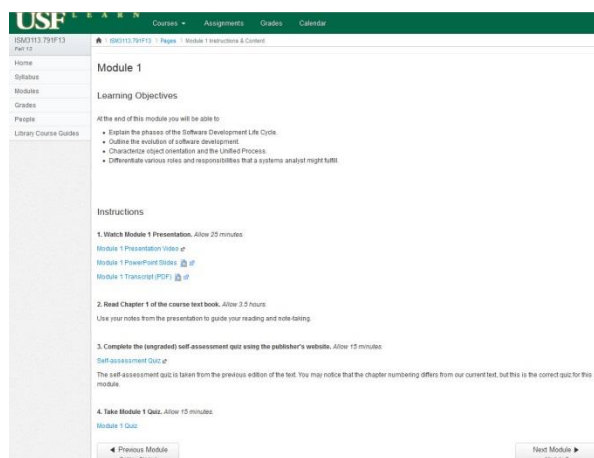
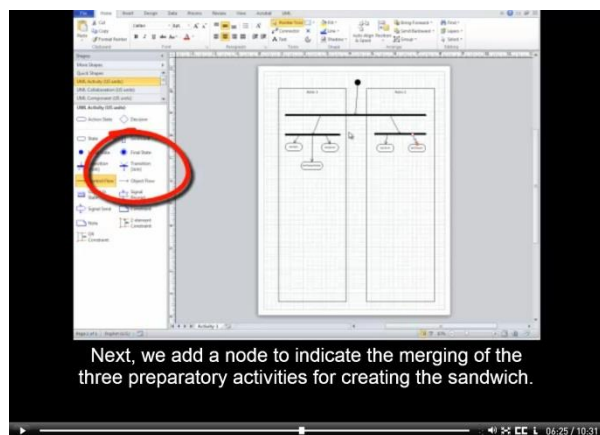


Figure 2 Example module navigation

Another UDI principle incorporated into this course that is of particular importance to the IS discipline was addressed through the inclusion of video and printable tutorials for the software programs required for the completion of practical assignments. Figure 3 shows an example of a video tutorial. Development of these assets allowed us an accessibility enhancement that was not achieved in the previous face-to-face iteration of this course. The inclusion of these tutorial materials meets the principle of tolerance for error. Students have 24/7 access to materials that can be retained and reviewed: the tutorials can be paced as needed so that, if they become stuck at any point in the process of completing the assignment, the student has immediate access to the instructions and visual demonstration. This enhancement has the potential to support students with learning disabilities that need to

review information multiple times; it also provides support for students with visual or auditory processing disorders by providing access in video and written formats. It also provides support more universally: experience has shown that these exercises prompt the most questions for students. The conceptual complexity of the UML modeling tools, the modeling software and the concepts that underpin them accentuate the gap between the most and least able students. All have the opportunity to review the tutorial to 'answer' a quick question.



**Figure 3** Closed captioned video tutorial

The second set of guidelines encompassed in QM Standard 8 is the WCAG developed by the World Wide Web Consortium. These guidelines strive to enhance technical accessibility to those students using assistive technology or needing alternative access to media elements to interact with the course. Following these guidelines makes content accessible to a wider range of people with disabilities and will often make Web content more usable to users in general (W3C, 2008). WCAG follows the POUR model of web design with four guiding principles to make the content Perceivable, Operable, Understandable and Robust.

One example of the WCAG applications within the course is the closed captioning and provision of transcript documents for all course videos. This meets the Perceivability principle to provide alternatives for non-text content and for time based media. Providing closed captions, which allows the students to turn captions on and off depending on preference and need, grants access to students who have hearing impairments, students with auditory processing

disorders, and students with learning disabilities to aid in note-taking. Figure 3 gives an example of closed captioning for course videos. It also provides access to students who don't have disabilities, such as a student viewing lectures in a library or in a noisy environment as well as students who speak English as a second language. Providing the transcript document for the videos allows access to a more specific group of students, such as a student who may be deaf-blind and needs to convert the lecture into Braille format.

The idea behind the comprehensive incorporation of these two sets of guidelines is to create a course that is usable and meaningful to all students and, by building accessibility from the early stages in the process, to eliminate the burden on students with disabilities to arrange for accommodation and to the instructors to modify materials to meet the needs of those accommodations after the fact.

## 5. SUMMARY

The three examples in this case highlight the substantial benefits of adopting a more holistic view of the course development process and the opportunities that addressing accessibility issues present.

The range and depth of cognate materials in the SAD course - conceptual content of the UML techniques such as Class Diagrams; the complexity of the semantic toolsets used to create the various models and the complexity of the software environment (MS Visio) presents a substantial range of learning outcomes. Figure 1 above highlights that this range generates an equally wide range of accessibility issues.

Those issues can - and should - be seen as both opportunities and challenges. The 'multi-dimensional' learning that characterizes the SAD course presents opportunities and challenges that affect a wider range of students than classes with more traditional learning outcomes that span a narrower range. This is pertinent to both the range of student abilities *and* to their expectations. The learning outcomes for the SAD course require them to do much more than memorize material (Topi et al, 2010). Assessment of the learning outcomes for this course also increase the range of assessment techniques used.

Reflecting on the challenges that we and our students had faced when the course was delivered in a hybrid (blended) format presented us with an opportunity to anticipate and preempt those challenges. In turn, that enabled us to explore further opportunities to both improve and widen accessibility. Our experience shows that it is both more effective – more cohesive in terms of faculty and instructional designer time and effort – and easier to design with accessibility in mind from the beginning.

The importance of collaboration is a key factor not immediately evident from the work of Kelly et al (2010). In order to bring the model in Figure 1 into 'being', close collaboration was critical to the success of our endeavor. Without close collaboration, the issues raised by the conceptual richness that characterize the SAD course would not have been explored as fully. An open, two-way dialog provided the opportunity for faculty to realize opportunities to adapt materials and process for the wider benefit of all students, rather than merely respond retrospectively to the limited utility of their material for those with specific disabilities. Simultaneously, instructional designers realized opportunities to enrich other courses using media developed to address the complex, 'multi-dimensional' learning outcomes of the SAD course.

In its previous (hybrid) form, the major faculty emphasis was on the course learning outcomes and the maintenance of relevant and up-to-date materials to support them. This led to an imbalance of effort between the sectors of Figure 1: as a consequence, students who experienced difficulty – either as a consequence of a specific disability or simply the limits of their learning skills – were dealt with in an *ad hoc* fashion. Typically, faculty support was retrospective – prompted by notification of a specific need – and represented additional effort for both student and faculty.

Our experience provides useful insight for future course design. Adaptation of existing guidelines such as the QM rubric can provide comprehensive guidance that can be used to initiate changes in both form (instructional media) and practice (course development process). Rather than using them simply as 'check lists' to 'audit' courses, the guidelines can be used to actively bring faculty and instructional designers to a shared awareness of accessibility challenges and opportunities,

highlighting their shared responsibilities. Figure 1 clearly infers the need for faculty, instructional designers and administrators to actively collaborate to optimize accessibility at universities.

We hope that this brief case has shown how such collaboration and (re-)defining roles and their responsibilities within the cyclic teaching, learning and assessment processes provides an opportunity to reconsider the timing of who does what in relation to accessibility, and at what points in course development, delivery and assessment.

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