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Analysis and Redesign of BannerWeb

Using a poorly designed web site to perform complex tasks can be an exercise in frustration. This can be explained by Cognitive Load Theory (Paas, Renkl and Sweller Page 2) which says that when the intrinsic cognitive load is already high, adding additional extraneous cognitive load can overwhelm users and prevent them from accomplishing the desired tasks.

As an example, consider BannerWeb (Fig. 1), the web site used to get registration status, choose courses, see schedules, pay tuition and handle many other school-related tasks. In my estimation, the site is poorly designed, both in the information architecture and the visual design. This poor design increases cognitive load and makes the site difficult to use.

Analysis of BannerWeb

The Information Architecture Institute defines information architecture as "...the practice of deciding how to arrange the parts of something to be understandable" (The Information Architecture Institute). An example of the poor information architecture of BannerWeb can be found on the login page (Fig. 1). The site visitor is presented with multiple ways to log in with no explanation of why they might choose *WPI Username* or

WPI ID Number. The WPI Username is called *Windows Username* in the bullet-point help above the login form.

 **Worcester Polytechnic Institute**

Members of the WPI Community may now Login to the WPI Web Information System using any of the following:

- Windows Username and Password
- Social Security Number and PIN
- WPI ID and PIN (Faculty may use their WPI assigned initials)
Please note: Your PIN is a minimum of 6 and a maximum of 20 AlphaNumeric characters.
[Click here if you have forgotten your PIN.](#)

Between 2 a.m. EST and 5:30 a.m. EST the server may be unavailable.

To protect your privacy, please Exit and then close your browser when you are finished.

**** Tuition Bills and Payment Options ****

Look at your latest invoices and account information by selecting the Student Services tab and choosing the option titled **e-Bills and e-Payments** or [Click here to make payment without a WPI PIN](#)

WPI Username:

Password:

OR

***WPI ID Number:**

PIN:

*ID Required to Reset PIN

[Forgot PIN?](#)

RELEASE: 8.7

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Figure 1 - Login page of bannerweb.wpi.edu - Accessed 12.4.2016

There are two links and a button that offer to “Reset PIN”; the links open a page that tells you to use the button (Fig. 2).

When you forget your PIN:

1. Enter your WPI ID in the **WPI ID Number** field and click the **Reset PIN** button.
2. Answer your unique security question* and click the **Submit Answer** button.
3. Enter and verify a new PIN.

***If you have not set a security question or attempts to answer the security question fail:**

Faculty, Staff, and Students:

Contact the [Helpdesk](#) at (508)831-5888 or send email to helpdesk@wpi.edu

Figure 2 - PIN Reset help page - Accessed 12.6.2016 - https://bannerweb.wpi.edu/wpi_help/help_pin.htm

In a conversation with a Helpdesk person¹, I was told that the PIN login is used mostly to set up the *WPI Username* which is what is required by most other WPI computer systems. Yet much of the login page, which does not require use of one's *WPI Username*, is devoted to administering the PIN associated with this alternate method of accessing BannerWeb.

¹ Private conversation on or about 10.26.2016

Another example of the poor information architecture is the page accessed by the *Student Services and Financial Aid* tab from the tabbed navigation bar (Fig. 3).

Worcester Polytechnic Institute

Main Menu **Student Services & Financial Aid** Personal Info Proxy

Search Go RETURN TO MENU SITE MAP HELP EXIT

Student Services and Financial Aid

Check-In
All attending **Undergraduate and Graduate students MUST CHECK-IN** each semester.

Registration
Check your registration status; Add or drop classes; Select variable credits, grading modes, or levels; Display your class schedule.

Student Records
View your holds; Display your grades and transcripts; Degree evaluations; Download enrollment certifications.

Academic Advising Menu
Links to Advising Information and Maintain Advisor Contact Preferences.

Student Accounts
Check status of your Student Account, tuition, fees and related charges. Residence Hall Damage Charges.
Make payments on-line. View IRS 1098T Tuition Statement.

Financial Aid
Review your Financial Aid document requirements, your cost of attendance, and your Financial Aid Award.

Medical Insurance Waiver/Purchase Form **Required Annually******
Purchase student medical insurance plan or complete waiver section (provide information on personal medical insurance policy).
WPI student plan information available at www.studentresources.com.

View Holds

Additional Information for Students
Click this link for additional student related web pages including:

- Student Policies
- Alcohol/Edu and Haven
- Student Course Reports (Course Evaluation Results)
- Housing Selection
- Campus Mailbox
- Goat Bucks
- Student Activities
- ID Image
- Answer a Survey

Answer a survey
Answer any surveys that are available to you.

ADLN Course Evaluations
Course Evaluations for ADLN courses now on-line.
-or-Answer any surveys that are available to you.

Curriculum Change Request
Submit a change request for major, concentration or academic advisor.

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Figure 3 - Student Services and Financial Aid page - Accessed 12.4.2016 -
https://bannerweb.wpi.edu/pls/prod/twbkwbis.P_GenMenu?name=bmenu.P_MainMnu&msg=WELCOME+%3Cb%3EWelcome,+David+C.+D%27Antonio,+to+the+WWW+Information+System!%3C%2Fb%3EDec+10,+201606%3A34+pm

In point of fact, the page labeled as *Student Services and Financial Aid* does not itself contain *any* information regarding Financial Aid. Rather, the only reference to

Financial Aid on the *Student Services and Financial Aid* page is a single link that reads “*Financial Aid*.” The link leads a separate page “*Financial Aid*” page (depicted in Fig. 4). Given the absence of Financial Aid information on the page titled *Student Services and Financial Aid*, the page should not give prominence to the terms “Financial Aid” in both the tab name and the page header. Many of the links on the *Student Services and Financial Aid* page go to pages of links but those terms and links are not featured prominently in the tab name and page header. In addition, the *Financial Aid* page doesn't have a corresponding tab in the tabbed navigation bar; the tab that *does* mention Financial Aid doesn't contain the actual financial aid links.

Worcester Polytechnic Institute

Main Menu **Student Services & Financial Aid** Personal Info Proxy

Search Go RETURN TO MENU SITE MAP HELP EXIT

Financial Aid

- My Financial Aid Award**
View Award information for the specified aid year.
- Cost of Attendance**
View the cost of attendance for the specified aid year.
- Check Status of Requirements**
Review the status of your requirements for the specified aid year.
- E-Mail WPI Financial Aid Office**
- Link to the On-Line FAFSA Application**
- Link to CSS PROFILE**
- Link to Student Gateway to Government Services**

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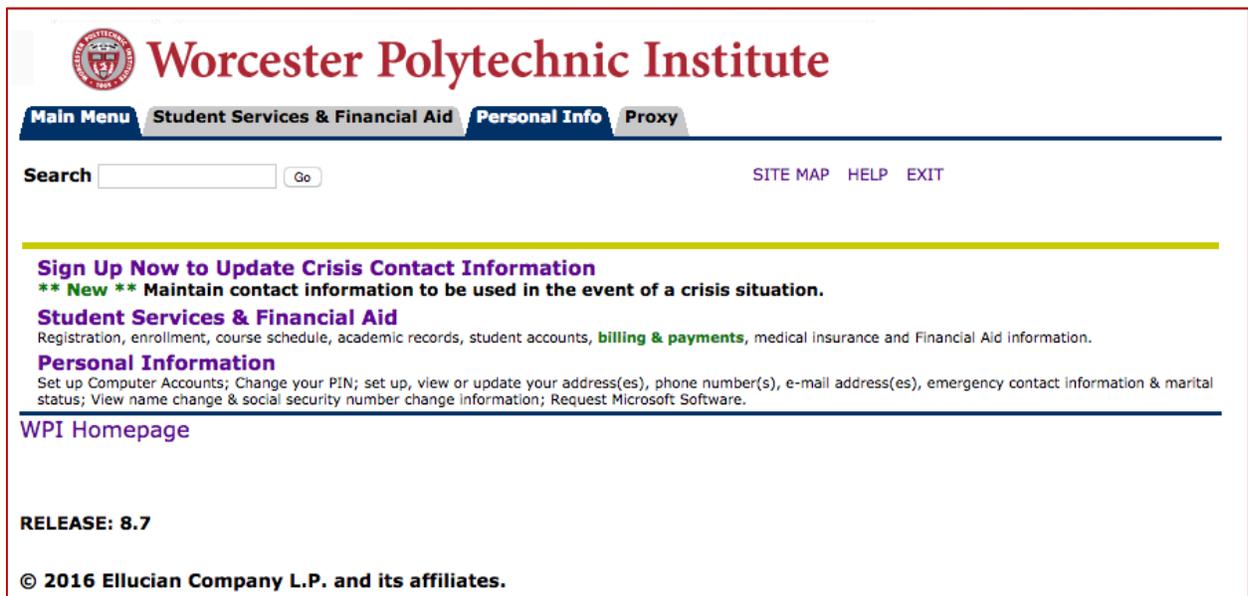
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Figure 4 - Financial Aid page - Accessed 12.6.2016 -
https://bannerweb.wpi.edu/pls/prod/twbkwbis.P_GenMenu?name=bmenu.P_FAAppStuMnu

The tabbed navigation bar is on most, if not all, of BannerWeb pages. Users access many information pages on the site, such as *Registration*, far more often than

they visit the *Financial Aid* page, yet most of these oft-visited pages also lack representation on the navigation tabs. This lack of good information architecture requires the visitor to remember extra information which, in turn, increases extraneous cognitive load (Whitenton).

Failing to conform to existing mental models of how tabs behave on web sites also increases extraneous cognitive load (Whitenton). Normally the selected tab is highlighted in some manner; this clearly tells the visitor to which tab the current content belongs. Yet the tabbed navigation bar (Fig. 5) has *two* tabs highlighted. Should the visitor select the *Personal Info* tab, they arrive at a different page (Fig. 6) with both tabs *still* highlighted.



Worcester Polytechnic Institute

Main Menu **Student Services & Financial Aid** **Personal Info** **Proxy**

Search [SITE MAP](#) [HELP](#) [EXIT](#)

Sign Up Now to Update Crisis Contact Information
**** New ** Maintain contact information to be used in the event of a crisis situation.**

Student Services & Financial Aid
 Registration, enrollment, course schedule, academic records, student accounts, **billing & payments**, medical insurance and Financial Aid information.

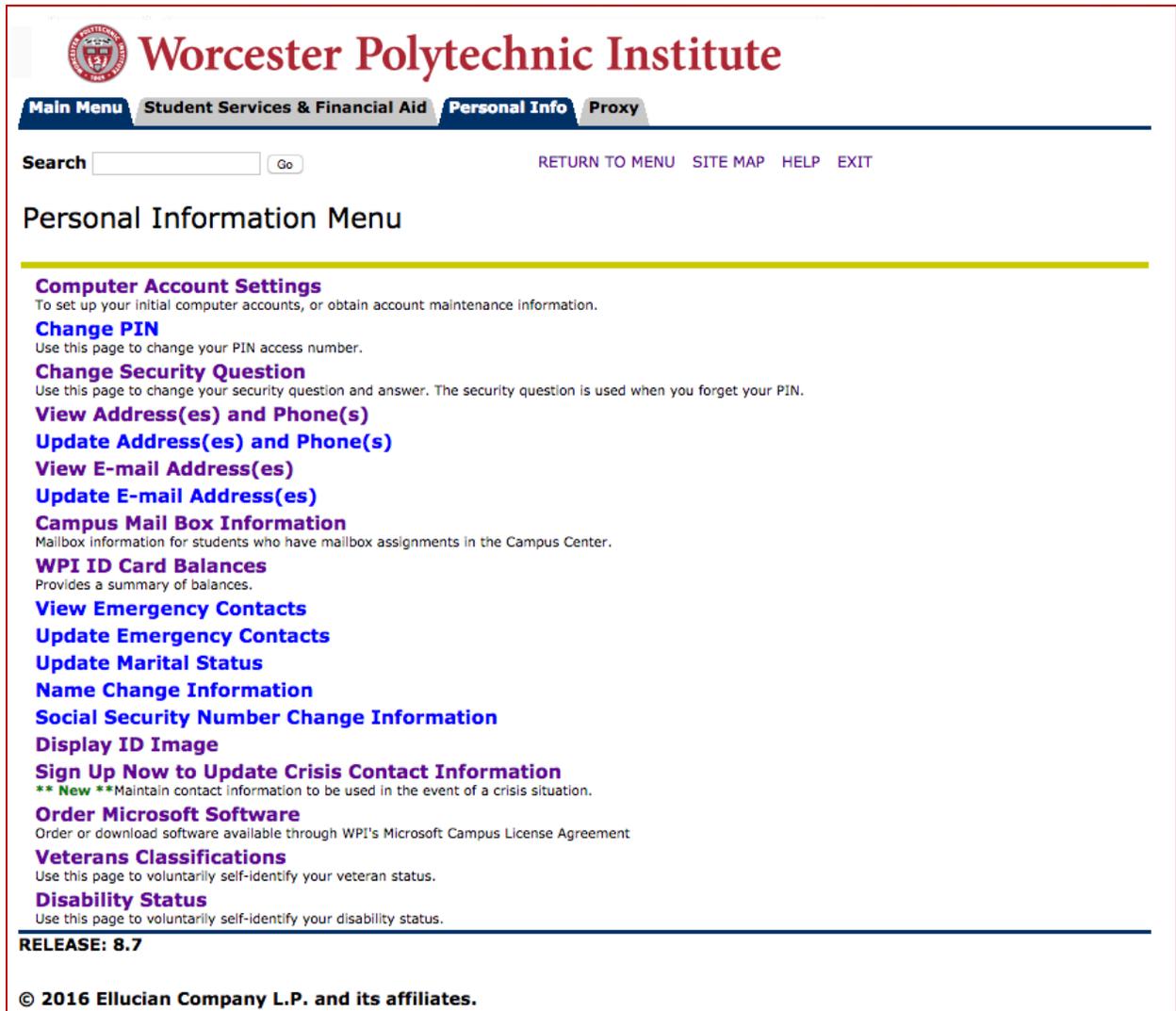
Personal Information
 Set up Computer Accounts; Change your PIN; set up, view or update your address(es), phone number(s), e-mail address(es), emergency contact information & marital status; View name change & social security number change information; Request Microsoft Software.

[WPI Homepage](#)

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Figure 5 - Main tabbed navigation bar - Accessed 12.3.2016 -
https://bannerweb.wpi.edu/pls/prod/twbkwbis.P_GenMenu?name=bmenu.P_MainMnu



Worcester Polytechnic Institute

[Main Menu](#) [Student Services & Financial Aid](#) [Personal Info](#) [Proxy](#)

Search [RETURN TO MENU](#) [SITE MAP](#) [HELP](#) [EXIT](#)

Personal Information Menu

Computer Account Settings
To set up your initial computer accounts, or obtain account maintenance information.

Change PIN
Use this page to change your PIN access number.

Change Security Question
Use this page to change your security question and answer. The security question is used when you forget your PIN.

View Address(es) and Phone(s)

Update Address(es) and Phone(s)

View E-mail Address(es)

Update E-mail Address(es)

Campus Mail Box Information
Mailbox information for students who have mailbox assignments in the Campus Center.

WPI ID Card Balances
Provides a summary of balances.

View Emergency Contacts

Update Emergency Contacts

Update Marital Status

Name Change Information

Social Security Number Change Information

Display ID Image

Sign Up Now to Update Crisis Contact Information
**** New ****Maintain contact information to be used in the event of a crisis situation.

Order Microsoft Software
Order or download software available through WPI's Microsoft Campus License Agreement.

Veterans Classifications
Use this page to voluntarily self-identify your veteran status.

Disability Status
Use this page to voluntarily self-identify your disability status.

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Figure 6 - Personal Info page - Accessed 12.3.2016 -
https://bannerweb.wpi.edu/pls/prod/twbkwbis.P_GenMenu?name=bmenu.P_GenMnu

One way to reduce cognitive load is to build up *schemas*. These are defined as “cognitive constructs that incorporate multiple elements of information into a single element with a specific function” (Paas, Renkl and Sweller Page 2). In the case of WPI’s BannerWeb site, poor menu structure undermines the creation of schemas. The menu system undermines the schema creation process because the system does not

establish and maintain a clear relationship among the tabs, the pages and the links on a page. One example of a lack of a clear relationship between the links on a page is the *Order Microsoft Software* link under *Personal Info*. Although located on the *Personal Info* page, this *Order Microsoft Software* link bears no relationship to one's personal information.

A final example of how BannerWeb's poor information architecture produces extraneous cognitive load is that the visitor must remember invisible context to understand the information BannerWeb displays on some pages. For example, If the visitor follows the *Look-up Classes to Add* link to search for classes, they must choose a semester—called a term by BannerWeb—in which to search. BannerWeb remembers that choice and should the visitor then use the *Student Detail Schedule* to view their schedule, BannerWeb displays their schedule for the previously chosen semester.

Should the visitor choose a semester in the future, this can result in the visitor being told they aren't registered if they haven't yet chosen classes in that future semester. However, BannerWeb doesn't *show* the saved semester choice so the visitor may well be confused if they are registered for the *current* semester. The visitor must remember the saved semester choice to make sense of the displayed information. This requirement to remember extra information increases extraneous cognitive load (Whitenton).

There are numerous other issues including each of the following:

- multiple links with different text labels all leading to the same page
- context-sensitive menus in yet another location—the footer—provided on some pages *but not others* (Fig. 7)

- links that display server error messages rather than useful information



Figure 7 - Context-sensitive footer menu - Accessed 12.3.2016

In addition to poor information architecture, I also believe BannerWeb lacks visual design consistency. Visual design is the use of imagery, color, shapes, typography, and form to enhance usability and improve the user experience (UX Booth). Having flawed visual design also increases extraneous cognitive load (Whitenton).

For example, most links conform to single style (Fig. 8). This style is blue text when the visitor's mouse is not over the link and WPI's brand red text with underlining when the visitor's mouse is over the link—known as the *hover* state. Once the visitor has clicked the link, it turns a purple colour when the mouse is not over it. However, some links are styled differently (Fig. 9); the link text isn't blue and doesn't change colour once clicked. Worse yet, some of the help text uses the same blue text colour as links but the help text is *not* a link (Fig. 10). All this weakens any schema the visitor might have created concerning links on BannerWeb.



Figure 8 - Normal and "hover" styling for links - Accessed 12.4.2016



Figure 9 - Green underlined links – Accessed 12.3.2016 – Fragment of
https://bannerweb.wpi.edu/pls/prod/twbkwbis.P_GenMenu?name=bmenu.P_StuMainMnu



Figure 10 - Coloured help text - Accessed 12.7.2016 – Fragment of
https://bannerweb.wpi.edu/pls/prod/bwskfshd.P_CrseSchd

While there is an attempt to use WPI's brand by placing an icon and logo in the header and by using WPI's brand colour as the *hover* colour of links, most of the site is very plain. Many pages are laid out as a list of links with minimal styling and explanatory text provided in a very small font size below each link. When buttons and other form elements are present, they are also not styled. The lack of styling on BannerWeb results in different presentations on different platforms and browsers.

“A group of German psychologists, following the lead of their founder Max Wertheimer, developed a group of theories of visual perception they referred to as The Gestalt Principles. These principles tried to describe how people perceive and process visual information” (Adorama Camera, Inc). The Gestalt principal of proximity states that a grouping of elements to creates a relationship or bond between those elements (Adorama Camera, Inc).

While often applied to photography, the principal is also relevant to visual design and layout, generally, and to web design, specifically. In the case of the BannerWeb site, a lack of any grouping of the links on each page hinders the visitor's ability to create a schema for the links on any particular page. The resulting lack of schema for link navigation frustrates any attempt to reduce the extraneous cognitive load.

“Whitespace,” or “negative space” is the space between elements in a composition (Boulton). Passive whitespace creates breathing room and balance (Boulton) and active whitespace is “...whitespace added to a composition to better emphasize or structure, information” (Boulton).

There is very little use of passive or active whitespace on most BannerWeb pages. This makes the site more difficult to read and interferes with any attempt to quickly scan a page. Preventing the visitor from scanning the page further increases the extraneous cognitive load required to use the site.

Redesign of BannerWeb

The extraneous cognitive load required to use BannerWeb can be addressed by redesigning the site. The redesign of BannerWeb presented below will improve both the information architecture and the visual design, including the use of whitespace and consistent styling of elements of the site.

By implementing better information architecture, the need to remember extra information can be reduced and schemas can be created that assist the visitor in using the web site. The less information the visitor has to remember, the less the cognitive load (Whitenton).

Adopting standard web visual design practices allows the visitor to use existing schemas derived from other web surfing experience. Good visual design includes the use of both active and passive whitespace, which can improve the readability of a web site as well as emphasize the structure of the information displayed thereon (Boulton).

The redesign makes use of Bootstrap 3², a widely adopted web framework. Bootstrap 3 is used on millions of web sites (Bootstrap 3) which can allow the visitor to recognize elements such as links, buttons and form fields from experience with other sites. Schemas created during these existing experiences can reduce the extraneous cognitive load (Whitenton) and make BannerWeb easier to use.

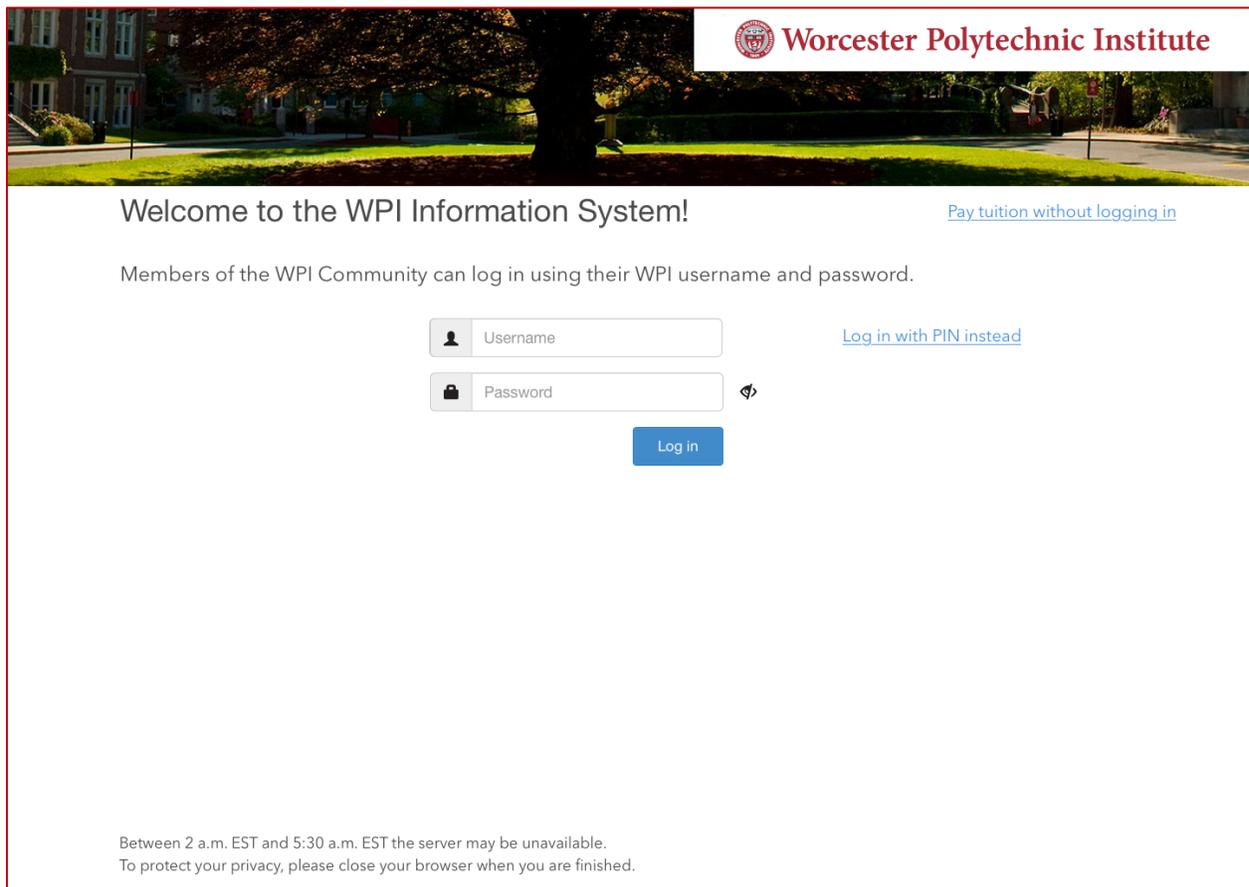
The redesigned Login page (Fig. 11) reduces the visual clutter of the current BannerWeb Login page by having one login form centered on the page. The Gestalt principal of Equilibrium “explains our search for balance in everything we see.” (Apogee Photo Magazine). By placing the form in the center of the page surrounded by ample whitespace, the page is balanced and, thus, the visitor’s eye is drawn to the form elements.

The *WPI Username* is used by most other WPI computer systems and so is the default choice. However, should the visitor want to log in using the PIN or need to pay tuition without logging in, these options are also available. By focusing the visitor’s attention on only one form extraneous cognitive load is reduced.

The placeholder text inside each form field clearly explains what the visitor must enter and the icon next to the field conveys the same information visually. In addition, the small eye icon, , is used to hide or show the password. This can further reduce extraneous cognitive load by making it easy for the visitor to enter the password properly.

² Bootstrap 3 - <http://getbootstrap.com/>

Other visual design elements include the WPI logo and a nice picture of a tree on campus. The tree is the central object in the picture; the logo to the right and the text welcoming the visitor to the left keep it in balance. The explanatory text is simple and is right next to the form to which it applies. Information on times when BannerWeb may be unavailable is at the bottom of the page; it can be referred to as needed but does not distract the visitor from completing the primary task of logging in.



Worcester Polytechnic Institute

Welcome to the WPI Information System! [Pay tuition without logging in](#)

Members of the WPI Community can log in using their WPI username and password.

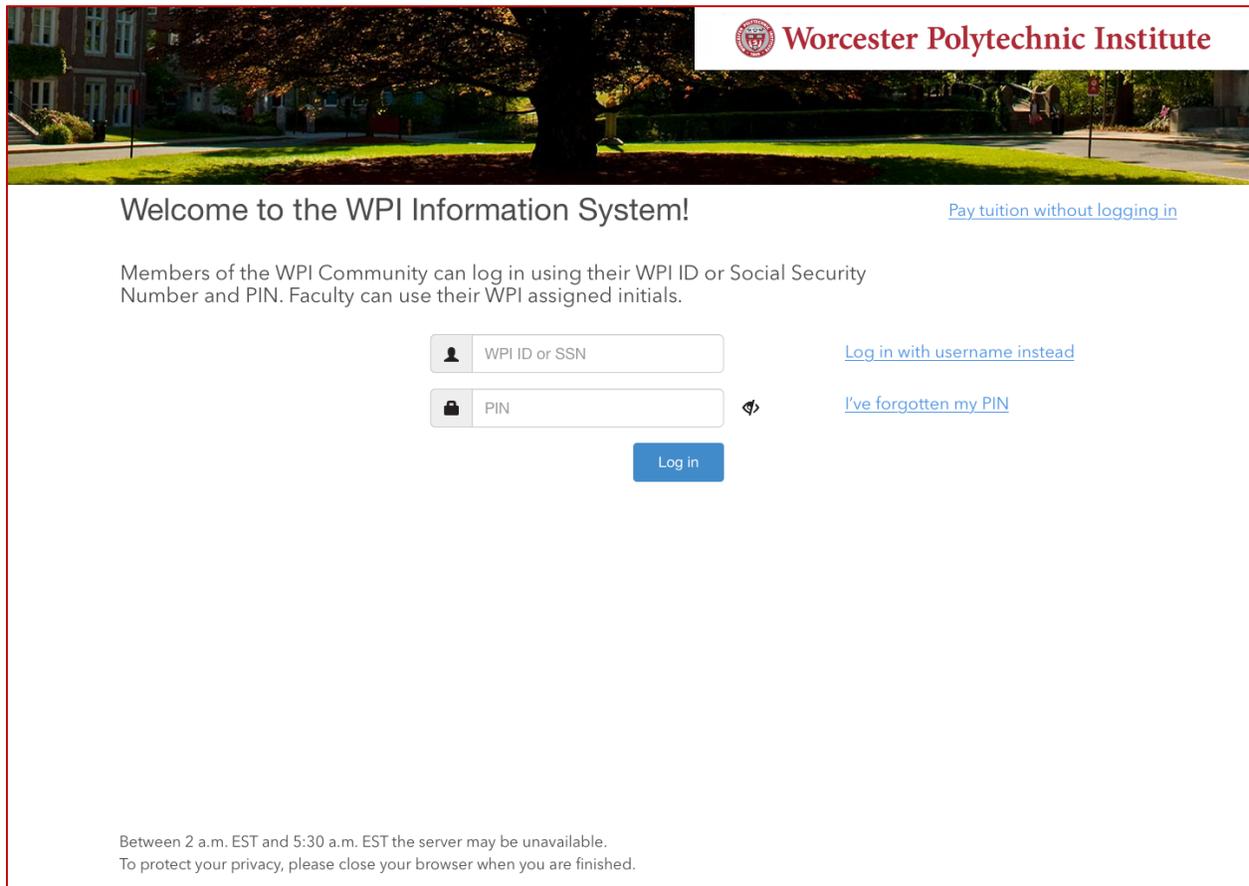
[Log in with PIN instead](#)

Between 2 a.m. EST and 5:30 a.m. EST the server may be unavailable.
To protect your privacy, please close your browser when you are finished.

Figure 11 - Redesigned Login page

The page to log in using a PIN (Fig. 12) is laid out in much the same way with the addition of a single link to reset the PIN. By keeping both pages nearly identical, the

visitor can reuse any schemas built up on either page to lessen extraneous cognitive load.



Worcester Polytechnic Institute

Welcome to the WPI Information System!

[Pay tuition without logging in](#)

Members of the WPI Community can log in using their WPI ID or Social Security Number and PIN. Faculty can use their WPI assigned initials.

[Log in with username instead](#)

[I've forgotten my PIN](#)

Between 2 a.m. EST and 5:30 a.m. EST the server may be unavailable.
To protect your privacy, please close your browser when you are finished.

Figure 12 - Redesigned PIN Login page

Once the visitor has logged in, they are brought to the *Student Services* page (Fig. 13). The header is visually consistent with the Login page with the addition of the visitor's name and a Logout link. The menu bar under the header has a *Search* box and underneath that is a *Help* button. This treatment appears on all other pages once the visitor is logged in giving the site a familiar user experience. This familiarity reduces extraneous cognitive load; the visitor can quickly find all these controls without needing to scan the entire page.

The screenshot shows the redesigned Student Services page for Worcester Polytechnic Institute. The header includes the WPI logo and name, and a welcome message for David C. D'Antonio. The navigation menu is located at the top, with 'Registration' highlighted in red. Below the navigation menu, there is a search bar and a 'Go' button. The main content area is divided into several sections:

- Registration:** A dropdown menu for 'Selected semester' is set to 'Fall 2016 (view only)'. Below this, there are five status messages with icons:
 - Warning: You haven't checked in yet. (Red exclamation mark icon) with a 'Check in' button.
 - Warning: You have no Registration Time Ticket. Please contact the registration administrator. (Red exclamation mark icon)
 - Warning: You have Holds that prevent registration. (Red exclamation mark icon) with a 'View Holds' button.
 - Success: Your Academic Standing permits registration. (Green checkmark icon)
 - Success: Your Student Status permits registration. (Green checkmark icon)
 - Info: Your Class for registration purposes is Senior. (Blue information icon)
- Earned Credit:**
 - Level: Undergraduate
 - Type: Institutional
 - Hours: 99.000
- Curriculum Information:**
 - Current Program: Bachelor of Science
 - Level: Undergraduate
 - Program: Computer Science Major
 - Term Admitted: Fall 19xx
 - Catalog Term: Fall 19xx
 - College: Part-time Undergraduate
 - Campus: Main
 - Major: Computer Science

At the bottom of the page, there is a footer with the text: 'Last web access on Dec 04, 2016 at 05:28 pm', 'Between 2 a.m. EST and 5:30 a.m. EST the server may be unavailable.', 'To protect your privacy, please close your browser when you are finished.', and a 'Sitemap' link.

Figure 13 - Redesigned Student Services page

The current page is displayed on the left of the menu bar in one of WPI's brand colours. This colour is also used in the selected menu item marker —in this case, *Registration* — and in the warning symbols on the page, , furthering the brand identification.

In this example page, the *Registration* menu has a submenu for actions related to planning and displaying schedules, and adding and withdrawing from classes. The other menu items, and any associated submenus, are similarly focused on a specific activity. Grouping tasks in a logical, rather than arbitrary, manner, is good information architecture (The Information Architecture Institute). It removes the need to remember

where to find a particular submenu item and removing the need to remember extra information certainly reduces extraneous cognitive load. (Whitenton).

The contents of the page continue the theme of reducing extraneous cognitive load by showing the visitor relevant status information without requiring them to leave the page. The semester to which the information applies is clearly displayed as is the amount and type of credit earned and the visitor's current program of study.

The status items displayed use familiar and colours — red indicates action needed while green indicates everything is okay — and standard Bootstrap 3 icons (Bootstrap 3) to allow the visitor quickly scan the page for items needing attention. Should an item need attention, a button next to that item allows the visitor to fix the issue by taking whatever action is possible within the system.

For example, if the visitor hasn't checked in yet (Fig. 14), a button next to the message prompts them to check in without leaving the page. This reduces extraneous cognitive load because the visitor doesn't have to interrupt their current task to remember how to fix an issue.



Figure 14 – An issue with its associated action button

As a final example, the *Your Schedule* page (Fig. 15) shares the same header and menu layout as the other pages, include the *Search* box and icons for *Help* and *Logout*. Unlike the current BannerWeb site, the selected semester is also shown to remind the visitor which semester's schedule is being displayed.

Information on the current courses, including grading mode, level and on which campus the course will be held are all prominently displayed. The instructor's name is also an email link —using the standard Bootstrap 3 link style— with the mail icon next to it as a visual cue to the purpose of the link.

Worcester Polytechnic Institute

Welcome, David C. D'Antonio

Student Services

Registration Student Records Student Accounts Student Info Financial Aid Holds

Add/Drop Classes Withdrawal Info **Your Schedule** Schedule Planner Planner Cart Registration Fees

Selected semester: Fall 2016 (view only)

VISUAL RHETORIC - WR 2310 - B01

Associated Term: Fall 2016
 CRN: 13277
 Status: Registered on Oct 26, 2016
 Instructor: [Alan G. Girelli](mailto:Alan.G.Girelli@wpoly.edu) ✉
 Grade Mode: AD/AC/NR
 Credits: 3
 Campus: Main
 Level: Undergraduate

Schedule for Visual Rhetoric

Type: Class
 Where: **Salisbury Labs 123**
 Date Range: **Oct 25, 2016 - Dec 15, 2016**
 Format: Lecture

	Mon	Tue	Wed	Thu	Fri
10:00 am to 11:50 am		█			█

Last web access on Dec 04, 2016 at 05:28 pm

Between 2 a.m. EST and 5:30 a.m. EST the server may be unavailable.
 To protect your privacy, please close your browser when you are finished.

Sitemap

Figure 15 - Redesign of Your Schedule page

The schedule for each course is next to the course information; this uses the Gestalt principal of proximity to tie both sections together in the visitor's mind (Adorama Camera, Inc). The course location, date range and time of the course are all in a bold font, which will draw the eye as the visitor scans the page.

The week grid next to the course time shows the days on which the course meets. The blocks use WPI's brand colours and the visual layout is easier to understand for a visitor familiar with a typical week view of a calendar than writing out the days as words. Ease of understanding lowers the effective cognitive load of the visitor (Whitenton) thus making the page more effective in communicating the visitor's schedule.

In summary, I've shown how the existing BannerWeb site suffers from poor information architecture and bad visual design; these flaws lead to high extraneous cognitive load and make BannerWeb a difficult site to use. A redesign of the existing site using good information architecture as well as a more modern and consistent visual design, such as has been presented here, can lessen extraneous cognitive load. The lower overall cognitive load will make a redesigned BannerWeb a more effective and easier to use site.

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