**CSCE 525 Research Paper Assignment (Fall 2018)**

Identify a problem

Provide background

Propose a solution

Try to submit to European Conference on Cyber Warfare and Security

* Ireland
* AFCEA Rocky Mountain Cyber Symposium?

ID a problem

Deconstruct problem

ID solutions and analyze

Pose a solution and support your conclusion with data/facts

Make something useful for AF senior leaders

Assert a position on a cyber topic and write a research paper supporting your claim.  Cite research from quality academic papers and consider using real-world data sets and subject matter expertise as supporting material.  Target a specific academic conference and format your paper according to their style guidelines.  Topics and conferences must be pre-approved in writing by your instructor.  Highly recommend submitting quality drafts for instructor feedback.  Successful submission to an academic conference may earn top grades.  400 points possible (40% of course grade).

General topics include, but not limited to, the following:

* Multi-domain Operations / C2
* Mission Assurance / Mapping the Mission
* Insider Threat Detection & Mitigation
* Cyber Workforce Development
* Cyber Risk Management
* Automated Cyber Defense Systems
* Managing Enterprise Maintenance
* Acquisition Reform in the Digital Age
* Cyber Weapon System Evaluation Criteria
* Cyber Theory (Strategic, Operational, Tactical)
* Community Specific Cyber Education (Air, Space, Nuke, Acquisition, Logistics, etc.)
* Cyber Hygiene

Topic/Venue Due (25 pts):   10 Oct 18

Abstract & Outline Due (25 pts):  22 Oct 18

First Draft Due (50 pts):  29 Oct 18 (Last Name A-F)

31 Oct 18 (Last Name K-O)

5 Nov 18 (Last Name P-Z)

Second Draft Due (50 pts): 19 Nov 18 (Last Name A-F)

21 Nov 18 (Last Name K-O)

26 Nov 18 (Last Name P-Z)

Final Due (250 pts): 5 Dec 18 (Last Name A-O)

10 Dec 18 (Last Name P-Z)

Abstract and Outline due 22 October

**Abstract:**

What is the problem?

What is the paper about?

Quantitative versus Qualitative

“The Value of this paper is….”

Why abstracts? Lots of data, a little bit of time.

What are the results?

Conference Process looks at abstract first

“This paper demonstrates…”

“We show that…”

“Show that the paper is quality”

Who is the intended audience?

Give to writing partner before handing it in.

**Research Paper Topic:** I am planning to focus my research on cyber workforce development and training. Specifically, I will highlight the need for Self-Directed Learning (SDL) to enable the creation and sustainment of life-long learners. As part of the research, I will explore how the Air Force is training its cyberspace operations officers that do not currently work in a cyber operations organization. Since this paper will focus on broad areas of cyber workforce development, I am planning to submit it to the European Conference on Cyber Warfare and Security. Additionally, since there is a strong Air Force connection, I will also try to submit it to the Armed Forces Communications and Electronics Association (AFCEA) Cyberspace Symposium in Colorado Springs, CO in February 2019.

**Abstract:**

The Air Force is currently conducting a complete overhaul of its education and training paradigm shifting from multi-month face-to-face programs to a modular, agile, on-demand design. This new initiative, referred to as the Continuum of Learning, plans to leverage advanced learning and education tools to create and sustain life-long learners in the Air Force. This is a lofty goal that can only be obtained by developing systems that leverage both people and technology to promote Self Directed Learning (SDL), a term coined by Malcolm Knowles in 1968. This paper describes the concept of SDL and explains its effectiveness in building and fueling life-long learners. This paper answers the question of what components are required in a learning tool to enable the development of people able to overcome obstacles and adapt to new challenges. Specifically, tools must be human-centered, intuitive, open, dynamic, and encourage collaboration. One emerging solution that contains basic forms of these elements is the Cyber Education HubTM(CEH). This cloud-based learning tool is designed to present crowd-sourced content on an intuitive platform that encourages community engagement and feedback. The CEHTM is focused on providing cyber education to a broad spectrum of personnel in the armed forces. While this system addresses the unique challenges of cyber education and training, it has the potential to inform the design of future Continuum of Learning systems without a direct link to the cyberspace domain. I conclude the discussion with an idea for a human subject experiment and other suggestions for future study.

**Video Topic:** Present my research paper. Since my research will be connected to a solution like the Cyber Education HubTM, I would like to make a video the shows and explains the different features of the CEHTM (KSA Tree, Map, etc.) and how DoD cyber professionals can use and contribute to it. I am going to craft the video to specifically target Cyberspace Operations Officers who are outside of operational cyber billets and may not have the resources at hand to keep up with the fast pace of cyber.

Video Outline:

* **Need:** Introduce the video and draw the user in by creating a desire for something like the Cyber Education Hub (CEH). Specifically, a platform that is designed around them, provides operationally relevant and easily consumable content in an environment that encourages initiative, exportation, and competition. At the same time, providing a pathway for all personnel to contribute their ideas, experience, and constructive criticism.
* **Task:**
  + My name is Nathan Flack, I am a Captain in the U.S. Air Force and this video has been created to partially fulfil the requirements of CSCE 525 – Introduction to Cyber Warfare & Security a course offered at the Air Force Institute of Technology.
  + **Disclaimer:** “The views expressed are those of the author and do not necessarily reflect the official policy or position of the Air Force, the Department of Defense, or the U.S. Government.” (Posted on intro slide that will be
* **Main Message:** Self-Directed Learning is an essential ingredient to build a workforce of life-long learners.
* **Point 1:** Definition of SDL
  + **Transition:** How does technology play a role in SDL.
* **Point 2:** Technology has transformed the tools available for SDL
  + **Transition:** One specific tool is ready for user engagement
* **Point 3:** Provide an overview of the CEH and how it supports SDL (Topic Map, KSA Tree, Contribute Content, etc.)
* **Review the main points**
* **Conclusion:** “in order to create life-long learners, your organization must provide tools and systems that promote self-directed learning”
* **Close:** encourage viewers to get a CEH account, provide feedback on the system, and start contributing to the solution.

outdated Air Force’s education methods do not provide the resources and tools to provide operationally relevant content to fuel life-long learning. This is changing with Air Education and Training Command’s focus on 21st Century Learning and its Continuum of Learning construct.

“…[T]he redesigned Continuum of Learning will change fundamentally how we develop the force. They innovations will allow us to be more agile, by equipping Airmen with skills and knowledge when and where they need it but will also help us to create and sustain lifelong learners.” (“The Redesigned Air Force Continuum of Learning” page 9 - <https://media.defense.gov/2017/Dec/05/2001852390/-1/-1/0/LP_0001_ROBERSON_STAFFORD_REDESIGNED_AIR_FORCE.PDF>

Where do education programs spend their resources to develop autonomous and motivated learners that can overcome obstacles and adapt to new challenges.

Human-centered tools that build self-directed learners must be intuitive for users, open, dynamic, and encourage collaboration. I identify the Cyber Education Hub as a solution to the problem and discuss ways the current implementation could be enhanced to promote self-directed learning. I conclude the discussion with ideas for a human subject experiments and other suggestions for future study.

Solution: a technical solution that provides a personal learning environment to promote self-directed learning. Using a self-directed learning model, I will suggest potential improvements to achieve the goal of creating a force full of life-long learners. Specifically,

Define the concept of self-directed learning and how it can inform the Continuum of Learning initiative and help to shape the tools currently in development

The analysis provided in ‘Rethinking USAF Cyber Education and Training’ [1] shows that current education and training efforts do not measure up to the challenges of scalability, currency, and complexity. A report Air Force Cyberworx [2] analyze this issue. They propose a potential solution that will motivate self-learning and self-improvement of cyber talents to meet their career goals and aspirations.

is a response to this issue. The framework suggests a platform built around the idea of crowd-sourced content, community engagement, and feedback.

The value of this paper is to apply research in self-directed learning to better inform the creation of 21st Century learning model.

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* Main Message:
* Preview:
* Point 1:
* Transition:
* Point 2:
* Transition
* Review:
* Conclusion:
* Close:

Notes:

Unfortunately, the sheer number of systems supported by a limited information technology budget means that cyber leaders are not only unable to protect everything, they typically don’t understand the complex web of technical dependences that enable operations either.[[1]](#footnote-1)

This implies that many more people outside of the cyber career field will need to be educated on cyber topics in order to not only correctly associate missions with enabling technologies, which may include weapon systems, mission planning systems, logistics systems, finance systems and so forth, but also correctly assess mission risk.

Problems:

1. So many people need training (scalability and breadth problem)
2. Cyber training needs to be updated much more frequently (currency problem)
3. Lots of prerequisites needed (complexity problem)

Review all the current major cyber training initiatives:

1. DoD Cyber Awareness Challenge
2. Initial Skills Training and USAF eLearning
3. Cyber Weapon System Training
4. Undergraduate and Graduate Cyber Education
5. Cyber Education for Leadership

Propose Framework

Make suggestions for future research

Operationalizing Cyber: Recommendations for Future Research (Reith)

<https://books.google.com/books?hl=en&lr=&id=uYiRDgAAQBAJ&oi=fnd&pg=PA295&dq=Operationalizing+Cyber:+Recommendations+for+Future+Research&ots=gKR6N8afiB&sig=qq5uQxIE7G3JE_S9FPmC2mBQy_8#v=onepage&q=Operationalizing%20Cyber%3A%20Recommendations%20for%20Future%20Research&f=false>

CEH Abstracts:

﻿(Rethinking) Over the past several years, the United States Air Force (USAF) has realized some deep implications of the axiom, “cyberspace is a warfighting domain.” Early pioneers understood that attackers and defenders would play a perpetual game of hide-and-seek over the exfiltration of data and the occasional web defacement. However, as the sophistication of attacks developed worldwide, it became apparent that the USAF’s key cyber terrain was becoming increasingly contested, along with the potential to hold military capabilities at risk. As the risk grew, two important transformations occurred. First, military functional communities (operations, logistics, support, medical, acquisitions, etc.) gradually became entwined in the cyber discussion as they assessed risk to their business processes. Second, the cyber community shifted from a culture of information assurance to a culture of resiliency and mission risk assessment. The challenge for cyber educators and trainers is to adapt and move past the traditional notions of static compliance and conformity, and embrace a more dynamic risk-driven resiliency approach. Furthermore, offensive cyber capabilities benefit from a similar resiliency perspective as future adversaries will no doubt make a similar transition. This paper analyzes current USAF cyber education and training efforts, identifies three core challenges, and proposes a 21st century teaching strategy for crafting and delivering content to address community specific needs in order to improve mission resiliency.

﻿(Engaging Airmen) Several issues have impeded the effectiveness of United States Air

Force cyber education and training in terms of ensuring that enough Airmen at all different levels of cyber education and training are appropriately prepared. The framework proposed in ‘Rethinking USAF Cyber Education and Training’ [1] is a response to this issue. The framework suggests a platform built around the idea of crowd-sourced content, community engagement, and feedback. This paper proposes several ideas of implementing gamification and human-focused design concepts on the platform and includes an analysis of how this can affect Airmen at different tiers of cyber development. Ideas relating to social involvement, introducing non-cyber-experts to the platform, and a navigable cyber topic map are proposed. These ideas are only a subset of the foundational concepts that can be applied to the platform; data from the platform should be used to continuously tailor the platform to maximize user engagement and consequently their cyber knowledge.

**﻿(Applying Game Elements) As cyber warfare continues to evolve and integrate into military operations, educating and training United States Air Force (USAF) members to be resilient despite a contested digital environment becomes increasingly important. In order to preserve a competitive advantage, more of the workforce needs to understand how adversaries erode military strength in order to dilute their efforts. Previous analysis on the current USAF approach identified three core challenges involving education opportunity, technical complexity and content currency. This paper continues the analysis by investigating how gamification elements can enhance motivation and engagement of a work force that may not necessarily have a strong technical background in order to improve learning outcomes. Furthermore, it reports on a prototype research platform called the Cyber Education Hub™ (CEH™) that attempts to address the aforementioned challenges as well as propose integrated gamification elements such as maps and skill trees based on the Octalysis framework. By creating an ecosystem that allows content contribution, organization, and goal setting, the CEH™ platform empowers Airmen to learn more about cyber concepts than traditional learning systems. Additionally, this paper provides a comparative analysis of CEH™ to contemporary platforms with a specific focus on viability in the military culture. A key question involves whether crowd sourcing of content can sustainably increase currency and improve engagement by empowering the workforce to contribute. Lastly, this paper outlines a human subjects experiment designed to measure motivation and engagement. The authors suggest that while necessary for cyber education, these findings may be generalizable to other fields of study as well. One of the objectives of this work is to provide practical options supporting the USAF’s continuum of learning education and training strategy.**

**Keywords:**

**Social media and education: reconceptualizing the boundaries of formal and informal learning**

It is argued that **social** **media** has the potential to bridge **formal** and **informal** **learning** through participatory digital cultures. Exemplars of sophisticated use by young people support this claim, although the majority of young people adopt the role of consumers rather than full participants. Scholars have suggested the potential of **social** **media** for integrating **formal** and **informal** **learning**, yet this work is commonly under-theorized. We propose a model theorizing **social** **media**as a space for **learning** with varying attributes of formality and informality. Through two contrasting case studies, we apply our model together with **social**constructivism and connectivism as theoretical lenses through which to tease out the complexities of **learning** in various settings. We conclude that our model could reveal new understandings of **social** **media** in **education**, and outline future research directions.

Informal Learning:

According the description of [Beckett and Hager (2002](https://onlinelibrary-wiley-com.afit.idm.oclc.org/doi/full/10.1111/j.1365-2729.2012.00481.x#b2)), informal learning is holistic, activity/experience‐based, dependent upon other activities, activated by individual learners, and is often collaborative ([Beckett & Hager 2002](https://onlinelibrary-wiley-com.afit.idm.oclc.org/doi/full/10.1111/j.1365-2729.2012.00481.x#b2), cited in [Colley *et al*. 2003](https://onlinelibrary-wiley-com.afit.idm.oclc.org/doi/full/10.1111/j.1365-2729.2012.00481.x#b1001)).

Personal Learning Environments: A solution for self-directed users

In this paper I discuss personal learning environments and their diverse benefits, uses, and implications for life-long learning. Personal Learning Environments (PLEs) are Web 2.0 and social media technologies that enable individual learners the ability to manage their own learning. Self-directed learning is explored as a foundation for the use of PLEs. I outline the optimal criteria for social media tools to be used as PLEs: they must be easy to use, open, dynamic, and offer collaboration options. I discuss individual PLE tools with examples and possible uses. I list implications for educators and individual learners. I conclude the discussion with ideas for future study of PLEs in formal and informal learning.

* “A study of intelligent, famous, or successful people in history would include a group who became so without the advantage of formal education, but were self-directed learners. Leonardo Da Vinci, William Shakespeare, Charles Dickens, Louis L’Amour, and Abraham Lincoln are among the list. Modern self-directed learners Steven Spielberg, Russell Crowe, Steve Irwin, and Bill Gates have constructed their success without completing a formal college education. “
* Note: self-directed learners are powerful and forge new paths

Self-Determined Learning (Heutagogy): <https://heutagogycop.wordpress.com/history-of-heutagogy/>

**﻿Serious Games may facilitate the development of self- directed learning (Percival, 1996; Stubbé & Theunissen, 2008).**

From (Bakhuys Roozeboom, Maartje, Gillian Visschedijk, and Esther Oprins. 2017. “The Effectiveness of Three Serious Games Measuring Generic Learning Features.” *British Journal of Educational Technology* 48 (1): 83–100. https://doi.org/10.1111/bjet.12342).

In self-determined learning, it is important that learners acquire both competencies and capabilities (Stephenson, 1994 as cited in McAuliffe et al., 2008, p. 3; Hase & Kenyon, 2000, 2007). Competency can be understood as proven ability in acquiring knowledge and skills, while capability is characterized by learner confidence in his or her competency and, as a result, the ability “to take appropriate and effective action to formulate and solve problems in both familiar and unfamiliar and changing settings” (Cairns, 2000, p. 1, as cited in Gardner, Hase, Gardner, Dunn, & Carryer, 2007, p. 252).

# The Adult Learner: The definitive classic in adult education and human…

Self-Directed Learning

Self-Direciton in Adult Learning

### **Self-Determined Learning: Heutagogy in Action (**https://books.google.com/books?isbn=1441191488)

﻿The Department of Defense (DoD) Strategy for Operating in Cyberspace was released in July 2011 and has five initiatives:

Strategic Initiative 5: Leverage the nation’s ingenuity through an exceptional cyber workforce and rapid technological innovation.

“Continue the Pursuit of Game-changing Technologies” – AF 30 Year Strategy (<https://www.af.mil/Portals/1/documents/SECAF/AF_30_Year_Strategy.pdf>)

The Adult Learner

<https://books.google.com/books?id=q2W2BQAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false>

<https://cte.smu.edu.sg/learning-resources/self-directed-learning>

self-directed learners are better able to transfer learning, in terms of both knowledge and study skill, from one situation to another;

Is this true? Does research back it up?

Sustaining Teacher Control in a Blog-Based Personal Learning Environment

<http://www.irrodl.org.afit.idm.oclc.org/index.php/irrodl/article/view/1397/2527>

Yet, the teacher must keep a balance between teacher control and learner autonomy in order to retain the effectiveness of self-regulated learning (Drexler, 2010). Similar arguments have been presented in organizational and workplace learning domains where a balance between individually driven learning and organizational guidance has been captured in concepts of knowledge maturation (Kaschig et al., 2012; Schmidt et al., 2009).

﻿

From Hayworth: Social Bookmarking as a PLE Social bookmarking sites allow users to quickly add, share, and bookmark or catalog web-based content in a personalized manner. Since sharing content is such an integral part of many Web 2.0 social media networks, there are overlaps from other categories. Reddit.com, StumbleUpon.com, Digg.com, andDelicious.com are among themost popular behind Facebook.com, Twitter.com, Pinterest.com, Google + and Tumblr.com. Social bookmarking sites include ratings systems in which users give added value to popular content such as likes, favorites, karma, and +1 s. Considering that many social me- dia tools offer sharing in one form or another, the social bookmarking category is one of the largest.

SymbalooEDU

From Hayworth: Social Bookmarking as a PLE Social bookmarking sites allow users to quickly add, share, and bookmark or catalog web-based content in a personalized manner. Since sharing content is such an integral part of many Web 2.0 social media networks, there are overlaps from other categories. Reddit.com, StumbleUpon.com, Digg.com, andDelicious.com are among themost popular behind Facebook.com, Twitter.com, Pinterest.com, Google + and Tumblr.com. Social bookmarking sites include ratings systems in which users give added value to popular content such as likes, favorites, karma, and +1 s. Considering that many social me- dia tools offer sharing in one form or another, the social bookmarking category is one of the largest.

SymbalooEDU as a PLE While many of the above tools could workperfectlywell foraPLEinanSDL setting, SymbalooEDU is specifically designed for educational use. SymbalooEDU is the educational licensed version of Symbaloo, dubbed BYour bookmarks and favorites in the cloud^, which is a social bookmarking and personal web- content organization service that includes curator features for individual learners, teachers, and school districts (Symbaloo 2015). SymbalooEDU allows the learner to store links to fa- vorite web materials (blogs, videos, news, rss feeds, images, etc.), sorted by the user on a screen called a BWebmix^. Each Webmix can be topic-specific or a collection of whatever links–called tiles–the learner chooses. SymbalooEDU allows educators and administrators to set up Webmixes for use by their learners and share them as needed. Once shared with learners, any changes to the original Webmix will be propa- gated throughout the screens of the learners. Webmixes may also be kept private and only viewed and edited by the learner. Setting up an account and beginning to create a Webmix full of tiles for any subject takes less than five minutes. Marín et al. (2014) used SymbalooEDU as the PLE and

home screen or starting point for all other aspects of a BTechnological Tools and Resources for Teaching^ course.

Throughout the course, screen shots of the learners’ Webmixes were evaluated. Total number of tiles (blocks or resources) that were shown in the screen shots nearly doubled from the start of the course to the end.

For future work:

(From Hayworth) ﻿Some cautions to be aware of with PLEs, and any

technology, are to not use PLE technology just for the sake of using PLE technology. Lee (2014) examined students’ perceptions of self-directed learning and collaborative learning with and without technology and discovered that the skills of SDL and collaborative learning should be taught before immersing students in technology.

“Engaging students in [technology-based] learning can empower them, but only if they are well prepared in face-to-face environments. It would be sensible for the teachers to first help students to acquire the skills of SDL and collaborative learning before bringing them to the [technology-supported] learning environments” (Lee 2014).

﻿For example, within the nursing profession, Bhoyrub et al. (2010) report that heutagogy provides a learning framework that addresses needs of nursing students, who must learn in an ever-changing environment that is both com- plex and unpredictable; a heutagogical approach to learning helps them to become lifelong learners, as well as “makes sense of the necessary uncertainties that defines nursing” (p. 326).

“Learning” is defined as “the process of gaining knowledge and expertise.”[[2]](#footnote-2)

“Self-Directed” refers to the concept of….---need definition and source---

---perhaps work in the concept of “unknown unknowns” and how SDLs will have the best chance to face these challenges when they arise---

Kim, Olfman, Ryan, and Eryilmaz (2013) conducted student interviews to determine the most important components and capabilities for a self-directed learning tool. ﻿Their findings show students valued “the ability to document learning goals, to maintain a list of learning resources, to schedule and plan study times and learning activities, to track performance of completed goals, and to self-assess accomplishments and new ideas for learning. The ability to share their goals and other SDL activities was thought to be very helpful for stimulating additional ideas for formulating goals, resources, and learning strategies. Also, students stressed the importance of being able to interact and communicate with one another synchronously or asynchronously.”

These findings have implications for the Air Force and its creation of its Learning Ecosystem, as well as other DoD organizations education and training mindset. The self-directed learning model provides a path to engage warfighters in order to take an active role in their education.

1. “Rethinking USAF Cyber Education & Training 2018-02-06.” n.d., page 2 [↑](#footnote-ref-1)
2. Knowles, Malcolm S., Elwood F. Holton III, and Richard A. Swanson. *The Adult Learner*. Routledge, 2012. [↑](#footnote-ref-2)