Week 7: Constructive Research Strategies

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# Constructive Research Strategies

Constructive design is one of the most common research methods for information systems and technology (Silvestrini et al., 2012). These studies identify a problem, build solution artifacts, and communicate the implementation’s unique value (Henver et al., 2004). For example, high-speed broadband internet is not available within many developing countries. These challenges promote researches to create new compression algorithms and improve the optimize the existing infrastructure. Typically, these results (artifacts) originate from specific Proofs-Of-Concept (POCs) or directed case-studies.

# Literature Review

Northcentral University’s Library contains thousands of articles, and five using constructive design methods were selected (see Table 1). These articles identify a specific problem within business and technology scenarios (e.g., networking and cybersecurity) and then produce reusable artifacts (e.g., business processes and hardware designs).

Table 1: Selected Articles

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Article | Problem Statement | Artifacts Produced | Effectiveness of Solution | Broader contributions |
| Emergency Communication | Communication systems are least reliable when they are most critical | Smartphone enhancements to address these scenarios | Addresses the problem with low power requirements | Reusable for other long-range / low-bandwidth scenarios |
| Measuring Cybersecurity | Comparing orgs. and prioritizing security posture is challenging | Qualitative bottoms-up framework | Reduces operational overhead | Applicable to any critical infrastructure project |
| Learning Strategies | Increasing student engagement produces better test results | Gamified curriculum for college courses | Student scores are one letter higher | Applicable to any instructor-led course |
| Menu Analysis | Customer-value and internal cost controls do not entirely overlap | An iterative process for optimizing menu design | Increased customer satisfaction and reduced wasted efforts | Applicable to any supply-chain scenario |
| Self-Service Analytics | Businesses want SSA but lack frameworks to measure its effectiveness | An iterative process for introducing SSA metrics | Increased insights into manufacturing processes | Applicable to any supply-chain scenario |

# Emergency Communication (2016)

## Problem Statement

Recently multiple political and natural events have disrupted communications during periods where system reliability is most critical. Abruawi et al. (2016) want to address these scenarios with a solution that is easy to deploy, operationally inexpensive, and supports many users across long-ranges. They propose modifying conventional smartphones to short wave radio transmitters that pair with receiving towers. The bandwidth of each short wave session is relatively low compared to other existing standards. However, in an emergency, the networking requirements are substantially less than interactive multimedia situations.

## Artifacts Produced

The researchers demonstrate the effectiveness of their solution by building an Arduino-based receiver and transmitter. Arduino offers a standard interface for several hardware components and enables engineers to prototype solutions rapidly. While their proof-of-concept has several limitations, those issues are more akin to budgetary restrictions. For instance, their artifact draws power from an outlet versus a full-system that must be battery-powered.

## Effectiveness of Design

External risks also exist with the practicality of this system. First, it requires receivers deployed across vast geographic spaces, necessitating multiple governments working together. Second, military forces could disrupt the signal and reduce its effectiveness during political events. Third, sensitive information needs additional layers of protection as its broadcasted thousands of kilometers.

# Measuring Cybersecurity Wellness (2018)

## Problem Statement

Comparing the security posture and maturity levels between two organizations is complex (Jazri et al.,2018). Many industry standards, like ISO 27001, attempt to solve this problem through vital sign metrics. However, the quantitative metric values use internal calculations that are meaningless externally. These standards also focus heavily on top-down policies, making it challenging to identify specific risk types.

## Artifacts Produced

The researchers propose a framework for assessing the maturity level of security-critical functions (e.g., monitoring and incident response). Definitions of each level come from a qualitative investigation into twenty critical infrastructure facilities. Their framework also places a strong emphasis on bottom-up reporting to catch more issues. After an organization completes onboarding into the framework, it can identify vulnerabilities and consistently compare itself against other businesses.

## Effectiveness of Design

Jazri et al. (2018) state that the onboarding process touches on twenty-question areas, making it easy to adopt. However, they do not provide any evidence this framework is superior to the numerous internationally recognized standards (e.g., ISO and NIST). Another challenge comes from the definitions are calibrated from twenty similar institutions. Without sufficient sampling entropy, there is a risk that other industries produce misleading results. For instance, a nuclear power plant versus a public blog has different expectations regarding a mature identity system.

# Learning Strategies for Business Programs (2018)

## Problem Statement

Students that spend more time studying receive higher grades in school. This relationship encourages educational facilitators to promote extracurricular engagements. However, there are limits to the student’s attention and desire to complete additional work.

Modern instructional training needs to incorporate the Revolution 4.0 technology to promote student engagement (Luna et al., 2018). The researchers expand their solution first approach to mean gamification of learning technology.

## Artifacts Produced

Luna et al. (2018) modified the curriculum for a business engineering course at a private university. These changes incorporate interactive online games that challenge the student’s knowledge of the lecture material. The course’s dashboard also exposes a leaderboard to inspire friendly competition between peers.

## Metrics Available

Each iteration of the course takes roughly fifteen weeks to complete with ten to twenty learners. The researchers evaluated test scores from before (2013 to 2016) and after the program (2016 to 2017). They found that cohorts received a full letter grade higher and reduced the standard deviation of scores by 50%. These results suggest that the pupils are spending more time studying and therefore understanding more material.

Their experiment and its results are rational, but there are risks that external factors are at skewing the data. Luna et al. do not provide any information about the amount of time students spend with the online content. Additionally, there is no evidence that the complexity of the test is consistent between 2013 to 2017. Further, it is possible that changing the instructor and retaining the previous material also improves test scores. The researcher’s artifacts are promising, but better variable isolation could improve broader adoption.

## Menu Analysis (2020)

Nemeschansky et al. (2020)

## Self-Service Analytics (2018)

Lizotte-Latendresse and Beuregard (2018)