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A final project presented to the faculty of the
Instructional Design Master's Degree Program
University of Massachusetts at Boston

Closing the Training Feedback Loop in a Research Environment

Submitted by
Graham Scott Holt B.A.

in partial fulfillment for the requirement of the degree
MASTER OF EDUCATION

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Dr. Carol Ann Sharicz

Approved by Dr. Carol Ann Sharicz, Faculty

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Closing the Training Feedback Loop in a Research Environment

Due to predictable and expected staff turnover, the Nelson lab is in a state of constant training. In order to detect areas in which training improvement efforts would be best spent, a needs assessment consisting of stakeholder interviews and digitally administered lab member surveys was conducted. Analysis of the interview and survey data revealed a number of problems, including a difficult to navigate documentation system and a failure to iteratively improve upon training materials.

The following goal was set forth:

Lab members should be able to make incremental improvements to training materials through the capture and integration of feedback into existing training materials.

Provided adequate documentation, instruction, job aids and time allocated to this task, the learner should be able to:

1. Explain a feedback loop.
2. Review training documentation in order to flag potential weaknesses.
3. Capture training feedback during and after training events.
4. Evaluate feedback for potential changes.
5. Collaborate with subject experts regarding potential changes.
6. Integrate updated content into existing training materials.

An engaging 90-minute training intervention was developed and pilot tested. By the end the session, the group had successfully demonstrated proficiency in objectives 1, 2, 3, 4 and 6. Practicing objective 5 and applying the lessons to existing training materials were discussed, but could not be accomplished in the time allotted. The training intervention was well received, and initial feedback from the pilot group is extremely encouraging.

Keywords

ADDIE, Constructivist_Learning, Experiential_Learning, Instructional_Design, Iterative_Improvement, Learner_Engagement Practice_Scenario, Training_Feedback_Loop, Training_Materials, Research_Environment

About the Author

Graham Scott Holt has many years of training and technical support experience in the biomedical field, and is a Technical and Training Specialist at the Laboratories of Cognitive Neuroscience at Boston Children's Hospital. His primary duties include maintaining many of the technical aspects of the lab and conducting training events, though this is only a fraction of what he does.

A self-proclaimed 'Jack of All Trades', Graham proudly provides creative solutions to the unique problems that arise in a research environment. Not all problems can be solved with training, and Graham uses everything that he can think of when tackling new challenges. He researches existing hardware and software solutions, creates custom electronics and fabricates solutions using traditional and digital fabrication techniques. Graham is at home wielding a hobby knife, soldering wires or manning the helm of a 3D printer, and delights in taking unconventional approaches to solving problems.

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Phase I: Analysis

Background Information

This project focuses on the training practices of the Nelson Lab of the Laboratories of Cognitive Neuroscience in Boston, MA. For the sake of brevity, this group shall henceforth be referred to as the LCN. This group consists of a handful of permanent staff (4), a relatively large number (15-30) of individuals who stay with the lab for an average of 2 years and a few (1-3) lab visitors who stay with the lab for 1-3 months in order to learn how to operate a neuroscience lab. These short stay visitors shall henceforth be referred to as Transient Lab Members or TLMs.

Due to the 2-year turnover of nearly every lab member, training is a necessary, but time consuming, activity.

This project aims to analyze the current training system, identify the issues that are most in need of improvement, design an intervention to address these issues, develop the required materials, implement the intervention and evaluate its effectiveness. In other words, the instructional design approach known as ADDIE - **A**nalyze, **D**esign, **D**evelop, **I**mplement and **E**valuate will be utilized (Dick and Carey, 2009).

Initial Research

Prior to starting the analysis phase of this project, some research was conducted. No relevant publications were found when searching for articles directly related to the training of visiting scholars or of the cyclical training of research assistants (RAs).

The search was broadened to include articles regarding high employee turnover. While the articles in this category contained information that is generally applicable to employee training, they focused on employee retention techniques including: adequate compensation, worker autonomy, meaningful work and a stable work environment (Hinkin & Tracy, 2000 and Whitebook & Sakai, 2003). However, the trainees at the LCN remain for a duration that is negotiated before they join the lab.

Publication searches on employee training cycles and seasonal employees resulted in articles that similarly did not apply to this situation.

Analysis Plan

Data Acquisition Instruments

In order to obtain sufficient data to analyze, two methods were used: stakeholder interviews and a survey. These instruments can be found in Appendix A - Data Collection Instruments (Questions-Stakeholder Interview and Survey- Nelson Lab Training).

Stakeholder Interviews

Two key stakeholders were identified and interviewed in order to gather initial information regarding the state of training and practices pertaining to the management of TLMs within the LCN. These key stakeholders were the Program Managers for the research and clinical branches of the LCN as these two individuals are responsible for directing the training and professional development efforts of all lab staff. Interviews consisting of open-ended questions were conducted with questions pertaining to training and the use of training plans for new lab members, with a special emphasis on TLMs.

Survey

A survey consisting of closed- and open-ended questions was administered via Google Forms to all currently active lab members that are called upon to participate in lab-based training activities (N=16). Demographic information was limited to the respondent's role and how long they had been with the lab. All surveys were confidential and no further identifying data was considered within the analysis of the data.

The core of the survey consisted of two parts, one dealing with training in general, followed by sets of training- specific questions. The general training section included 3 attitudinal questions about using time to be trained, to train others and to create training documentation. After the general questions, respondents who claimed to have conducted training in the past 6 months were asked to provide additional information regarding specific training topics. A partial list of

trainings conducted within the lab was provided in order to maintain the focus of the survey. Additionally, each respondent was limited to providing details on 5 training topics. A final open-ended question was included, allowing for an opportunity to capture any remaining thoughts regarding training.

Analysis Report

Interview Results

Interviews were conducted utilizing Questions - Stakeholder Interview within the offices of the respective stakeholders. Each stakeholder answered all questions as they related to the current and past situations within the lab. Clarifying and probing questions were asked in order to obtain complete and clear answers to all initial questions. Applicable and relevant comments that were not directly related to the question at hand were also recorded and were used within the following analysis.

Using qualitative analysis methods as outlined by Sleezer, Russ-Eft and Gupta (2014), reveals common threads between the interview responses of the two Program Managers including the lack of formal training plans for TLMs, that the training of TLMs has many direct benefits and that training may be burdensome to some of the lab members.

Lack of TLM Training Plans

Each TLM comes to the LCN with different experiences and goals. Generally speaking, a TLM will require training for one of two roles:

1. Supporting of daily lab activities (Type 1)
2. Establishing a remote lab (Type 2)

Type 1 TLMs will have training needs dependent on what they will be doing within the lab; this generally includes a combination of data entry, data analysis, assisting in data collection and interacting with families. No physical or digital training plan exists, and it is up to the Program Manager to direct training activities based upon the needs of the project and skills of the TLM.

Type 2 TLMs have training that is more structured as there are many skills in which a Type 2 TLM must gain competency on a strict timeline. Currently, a training schedule template is modified to suit the needs of the project and the skills of the TLM. The Program Managers are responsible for how tasks are completed. There is no 'skills checklist' to aid the TLM in tracking their progress.

Benefits of Training TLMs

While the benefit to training regular lab members is clear, the benefits to training TLMs is not so easy to see. Type 1 TLMs directly support the daily and routine lab activities, which free up RAs to focus on more skills intensive tasks.

The training of Type 2 TLMs is resource intensive and can be highly disruptive to senior lab members. However, the activities in which Type 2 TLMs then engage directly support the mission of the LCN (below), so their training is a worthy use of time.

The Laboratories of Cognitive Neuroscience are dedicated to furthering our understanding of brain and cognitive development in typically developing infants and children, as well as children diagnosed with or at risk for various developmental disorders. In gaining a better understanding of these processes, our goal is to contribute to the healthy growth and development of our children.

Additionally, both types of TLMs are avenues for inspiring the next generation of scientific research within the field and provide valuable opportunities for lab members to learn and practice training, mentoring and documentation skills.

The Burden of Training

Current lab members have extremely full plates when it comes to duties before taking into account the need to train others. Training others may be thought of as something extra that is piled on top of existing duties. This may be especially true if training duties are not conducted regularly or if training documentation is not readily available so that trainers must scramble to prepare while allowing their regular duties to suffer.

Survey Results

Data was collected over a 10-day period over which time one reminder was sent out. Participation was not required, though it was strongly encouraged. Out of 16 potential respondents, there were 15 survey participants resulting in a response rate, and confidence rate in survey results, of 93%. The make-up of survey respondents is fairly representative of the lab with a good mix of RAs, post docs and staff with response rates of 75% or greater for each group. Information gathered regarding individual training topics was aggregated in order to pick out larger trends that were not clear by looking at individual topics. While no survey is 100% conclusive, the high response rate and the representative respondent mix support that this data is representative of the participant pool.

The breakdown of time since joining the lab revealed that 73% of respondents have been with the lab for longer than a year, which could potentially bias the data towards those that have become more acclimated to the training culture within the lab. This potential bias and low sample size could be overcome by gathering similar data from new lab members over the course of several years in order to identify potential trends.

When asked if they could benefit from additional training, 90% of applicable respondents agreed that they could. The most frequently requested additional trainings were:

- EEG Processing
- ERP Processing
- Data Analysis
- Statistical Analysis Methods

When asked about training in general, the majority of lab members agree that both training (85%) and training materials (77%) are adequate. With regard to documentation, respondents identified the following trainings as lacking adequate documentation:

- E-Prime Acquisition
- EEG Data Processing
- Redcap Data Entry

When asked regarding training materials on topics that they had trained, the aggregated response revealed a rate of 62% adequacy.

Ninety percent of aggregate responses agreed that current training approaches are effective.

Eighty-five percent of respondents that had trained others have created training materials, and 80% of material creators noted that other lab members were aware of the existence of those materials. When it came to ensuring that those materials were available on the public lab server, only 33% said that they did this. It was found that some materials are available on study specific servers, so the wording of the question is causing an artificially low measurement of document availability. The actual availability of documentation is likely greater than 33%, but less than 100%.

Analysis of open-ended questions revealed that the members of the LCN understand the importance and need for training. Survey respondents noted concerns regarding time constraints, documentation management and the desire for formalized training.

Importance of Training



Figure 1: Word cloud plotting size of words relative to the frequency of appearance in response to a survey question regarding the training of lab members.

When it comes to training others, the most common word encountered within the open-ended questions aside from train(ed, ing, s) was important. Essential, share, happy and good also make the top 20 words as illustrated in figure 1. While the importance of training to the members of the LCN is clear, the reasons for doing so were scattered. While

individual reasons cited collectively support the LCN mission statement, only one respondent explicitly referenced training activities being vital to the mission of the lab.

Time Constraints

Several respondents mentioned that the lack of time played a role in impeding training efforts. These comments included both the time constraints of trainers and trainees. The breadth of skills within the LCN is large, and obtaining holistic knowledge of lab activities and processes is difficult without concerted and dedicated training efforts. One respondent summed it up well:

I was also exposed to all sides of research from the start (i.e., admin, experiment creating and design, recruiting, scheduling, collection, processing, and analyzing data). This was essential for me not only to have a better grasp of the project as a whole, but for data integrity, interest and motivation, and feeling trusted and respected by my supervisors. Other team members at the time were not able to do all these aspects of the project (no clue why) and it was noticeable their level of commitment, understanding, willingness, ability to troubleshoot and collect good quality data was drastically different from my experience.

Lab Apprenticeship vs. Formal Training

Survey respondents recounted that while the current hands-on practices of what amounts to ‘lab apprenticeship’ are vital to gaining the required skills of a productive lab member, these activities can sometimes lack focus. In addition to such apprenticeship activities, a desire for more formalized, well-documented group trainings was repeatedly expressed. Current formal trainings have been well received and may be a more comfortable environment for those who are accustomed to a system of classroom training. Others touted the virtues of hands-on, apprenticeship-style instruction as being a key way to learning highly detailed procedures.

Documentation

While documentation was cited as being an invaluable resource, it was also noted that there are some problems with how the lab currently creates, uses and disseminates documentation. Multiple respondents voiced concerns of creating documentation that is never used by anyone.

Documents that are actively used, such as protocols and other ‘working documents’ that are kept current are a valuable resource, but documents that are placed on the server for a future ‘document archeologist’ to potentially find and make use of are not being effectively utilized.

Investigation into the state of the organization of these resources revealed a confused set of documentation with a broken organizational structure that has deteriorated over the past several years. Documents that are known to exist can be difficult and frustrating to find since they could be several folders deep within a parent folder that may have made sense at one point, but is nonsensical now.

Analysis Conclusions

The LCN is currently in a functional state when it comes to training, but recent pressures to conduct more training of TLMs has pushed the current system towards a potential breaking point. In order to proactively avoid a training meltdown in the future, action is required to create a more effective and efficient training program.

Three areas of concern stand out with regards to this problem:

- The lack of training plans for TLMs
- The way in which documentation is created/stored/shared/utilized
- Priorities as supported by the management and the collective attitude of the lab towards training and maintaining training documentation.

Due to the breadth of training problems outlined in Phase I and the required scope of this project, not all of the problems identified can be immediately and adequately addressed. Specifically, the remainder of this project focuses on the following problem:

Feedback from training opportunities is not adequately captured and rolled into existing documentation, resulting in no iterative improvement in training materials.

Phase II: Design

The design of this project focuses on closing the training feedback loop at the LCN. It should be noted that the problems uncovered in the needs analysis are extensive, and that this project represents only a small step towards their resolution.

Performance Goal & Learning Objectives

Performance Goal

Lab members should be able to make incremental improvements to training materials through the capture and integration of feedback into existing training materials.

This goal represents a fundamental shift in the attitudes that are taken towards training. As the goal relates to Kirkpatrick's levels of training, the 3rd and 4th levels, behavior and results, must be addressed. At the behavior level, trainees must learn new behaviors and procedures. At the result level, the iterative improvement of training materials over time is the main goal. Additionally, an organization-wide change in approach towards training is required. Training should be viewed as an opportunity for improvement not only of the learners, but also of training materials.

Any organization-wide change in approach requires developing and fostering new attitudes throughout the organization (Kirkpatrick, 2006). Such a change necessitates manager-level buy in and commitment from the beginning of the project. Failure to obtain such support will undermine this sort of project (Brown & Harvey, 2011). In other words, employees can gain skills and know how to use procedures, but an intervention is a waste of time if their managers do not support and embrace their use.

The management of the LCN is eager to support any effort that will improve the current training documentation situation. Moreover, the management is fully understanding of the small, but important, step that this project represents.

Learning Objectives

Provided adequate documentation, instruction, job aids and time allocated to this task, the learner should be able to:

1. Explain a feedback loop.
2. Review training documentation in order to flag potential weaknesses.
3. Capture training feedback during and after training events through the use of note taking and post-training surveys.
4. Evaluate feedback for potential training material changes.
5. Collaborate with subject experts regarding potential changes.
6. Integrate updated content into existing training materials.

Instructional Strategy

Approach

The general approach to instruction is to expose the learner to the material in three stages: first as general theory, followed by a practice section and finally a discussion of these new practices within the specific context of LCN training. In establishing theory, a constructivist approach is taken in order to engage with the learner to improve material retention (Merriam and Bierema, 2014). Furthermore, this approach allows for an opportunity to explore the topic in relation to the learner's previous experiences.

A small group practice session fosters the further development and encoding of the lesson (Merriam, Caffarella and Baumgartner, 2012). This practice session is experiential in nature and features a simple example to allow learners to become familiar with the process of iterative documentation improvement in a controlled environment prior to integrating this process into their regular training activities.

Design

The design of the instructional materials is such as to minimize the amount of overlapping visualized and spoken text in compliance with the Redundancy Principle (Clark & Mayer, 2011). The LCN has historically struggled with this principle, so this intervention acts as a good example for the group.

Supporting documentation is consistent in design and includes features that are new to the group. Such features include a document version number, the date the document was modified and the initials of the person who last modified the document.

Assessment

Assessments for the intervention were conducted in the form of both pre- and post-training surveys. Follow-up survey questions relate to the attitudes and processes regarding the updating of training materials. All survey questions are designed to be brief, objective, simple and specific in nature to avoid confusion or leading the survey participants in their responses (Iarossi, 2006). A follow-up survey will also be sent out to participants three months after instruction in order to evaluate the effectiveness of this project. As it is the collective behavior of the group that this intervention aims to change, the primary metric for success will be the integration of new procedures into routine training activity.

While some training events may occur monthly, such as with new employee onboarding, there are others that occur only annually. This being the case, a three-month evaluation period will not be sufficient to capture these less frequent training events or the behaviors of some trainers. As there may be a substantial delay between this intervention and the use of these skills, training must be both experiential in order to help trainees further learn the new behavior (Merriam, Caffarella and Baumgartner, 2012) and include robust job aids in order to make the process easy to utilize and to refresh the memories of trainees (Norman, 2013).

Lesson Agendas

<i>Lesson/Topic</i>	<i>Objectives</i>
Lesson - Feedback Loops Concepts	
Introduce the concept of feedback loops	1
Introduce new workflow for the training cycle	1
Applied Practice	
Practice in small groups (simple example)	2,3,4,6
Lesson - Feedback Loops Applied	

Introduce tools - surveys, process and worksheet	2-6
Practice tool use	2-6
Collaborate with subject experts	5
Update documentation	6

Table 1: Lesson agendas and the objectives they address.

Phase III: Development

Introduction

In order to successfully engage with the target audience and to provide a productive learning experience, a number of materials utilizing a variety of techniques were created for this project. The majority of the materials created for this project support a primary presentation, which was created in Microsoft PowerPoint. Surveys to gather pre- and post-training information were created as Google Forms. Worksheets, paper surveys, activities and processes were created in Microsoft Word. An additional survey and worksheet were also created in order to support the learners in their documentation improvement efforts after the training had concluded.

In addition to the creation of these more traditional training materials, physical materials for the activity were produced utilizing a 3D printer. For a practical demonstration of feedback loops in action, an ominous looking box dubbed the ‘hand shredder’ was created by physically altering a salvaged piece of scientific equipment.

Instructional Materials

Core Presentation

To facilitate the communication of the training’s content, a PowerPoint presentation titled *Exploring How We Update Training Materials* has been created (Presentation - Exploring How We Update Training Materials 1.0 in Appendix B - Instructional Materials). This presentation is broken down into three sections of theory, practice and resources/LCN specifics. In this way the learner is provided enough background information so that their previous experiences are engaged, they can apply the theory to a simple example and then explore ways in which they can apply the approach to their work.

Improve- Distribute



Image 1: Presentation slide outlining the steps of distributing improved training materials. The use of large icons adds a visual element to what would have otherwise been an un-engaging list.

The presentation was designed with the Redundancy Principle (Clark & Mayer, 2011) in mind, and contains a minimal amount of text. Text is only used when necessary and when it is the best way to convey a given message. Images, graphics and icons are used liberally so that words spoken by the presenter are complimented by what the learner sees.

The beginning and ending of each section are presented in the same way in order to clearly indicate transitions and to allow for the checking of comprehension. This use of repetition acts as a cohesive force, holding the various elements of the presentation together (Dondis, 1973). Additionally, the use of representative images in the comprehension check slides act as a sort of wayfinding device, allowing learners to easily identify where they are in the presentation (Lipton, 2007).

The theory section of this presentation covers the topics of feedback loops, training feedback loops and the 4 Cs of document improvement (clear, complete, consistent, concise). These topics are frequently experienced, and by providing vivid examples, graphic representations and a little bit of humor, learners recall previous applicable situations and make stronger connections to new material than possible without the recall of previous situations (Merriam, Caffarella and Baumgartner, 2012). Engaging learners in discussing the theory of the presentation readies them to apply that theory in a practice situation.

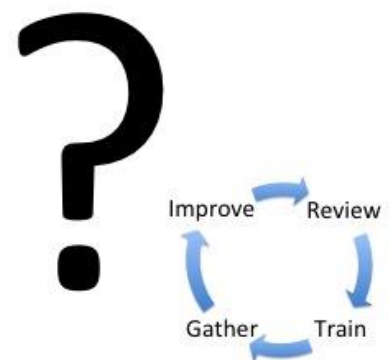


Image 2: Presentation slide highlighting the use of a representative image from the section in a comprehension check, acting as a wayfinding device for the learner.

The practice section of this presentation is covered in detail within the Keychain Assembly Activity section below.

The final section of the presentation covers resources including a sample post-training survey and an expanded version of the training improvement worksheet used in the Keychain Assembly Activity, which can be found in Appendix B - Instructional Materials (Survey - Sample Post-training and Worksheet - Training Improvement). These resources can then be used after this training is completed in order to improve training materials.



Image 3: Presentation slide highlighting the importance of document completeness. The creative use of images offers an opportunity to inject humor.

Changes to the training improvement worksheet are briefly discussed, with the main addition to this document being the consultation with subject matter experts at various stages in the process. Archiving older versions of documents and the concept of a lab style guide are also discussed.

Keychain Assembly Activity

At the core of this training is an activity in which the learners are to be provided with a set of materials, tools and simple instructions for creating a bottle opener keychain. These materials can be found in the Appendix of Instructional Materials (Activity - Keychain Assembly). The activity document includes not only instructor information such as activity timing, notes and a list of required materials, but also three supporting documents that are provided to the learners during the course of the activity. These supporting documents are Process - Keychain Assembly, Survey - Post-training and Worksheet - Training Improvement (short).

Process- Keychain Assembly 1.0**Purpose**

The purpose of this process is to assemble a bottle opener keychain.

Instructions

1. Insert penny into keychain slot
2. Spread split ring with fingernail or staple remover
3. Slide split ring onto keychain

Image 4: Minimal, yet easily followable instructions that learners improve using iterative document improvement techniques.

The Process - Keychain Assembly is designed to be minimal, yet allow the users to figure out how to complete the task that they must improve. In addition to the instructions, the learners are provided with a copy of Worksheet - Training Improvement (short), to walk them through the document improvement steps (review, train, collect and improve) that are

discussed prior to this activity. With the minimal instructions, a scaffold for learning the task and an instructor standing by, this is an ideal environment for constructionist-style learning (Merriam and Bierema, 2014).

Finding the right balance between challenge and frustration is the key to making this activity successful. The activity is not about the task of assembling keychains, but rather it's about the process of improving the documentation. As such, if the instructions were too minimal and could not be understood, learners would become frustrated with the task and lose focus on the process. If the task instructions were too complete, the learners may struggle in finding ways in which the task documentation might be improved. Providing just enough information for learners to fill in the details provides them an opportunity to apply their previously acquired knowledge. As such, this portion of the activity may need to be adjusted if it is used with a different audience to account for varying skill levels.

While the instructor is present during this activity, they are encouraged only to answer questions, provide updates regarding the time remaining and to gently prod the group along if they become stuck. This is an activity in which the learners get to apply their own skills to solve a problem in a way that they see fit. The provided materials should provide enough structure so that the group completes each step. How they complete each step is up to the learners.

This type of problem-centered learning is both engaging and allows learners to put into practice the theory that was just discussed, which reinforces learning (Merriam and Bierema, 2014).

Once the Process - Keychain Assembly has been completed, Survey - Keychain Assembly is administered within the group in order to gather ideas about improving the documentation that they just used. This survey covers areas of improvement including the 4 Cs of Document Improvement (clear, complete, consistent and concise) as well as general document improvement questions. Once answers have been compared, a plan of how the group might improve the document will likely have formed. Time permitting; a rough draft can be sketched out by a member of the group.

Were the instructions:

Clear? ____ Can clarity be improved?

Complete? ____ Is there anything missing from this document?

Concise? ____ Can the document become more concise?

Consistent? ____ Are styling and wording and consistent?

Image 5: Survey questions regarding the 4 Cs of document Improvement.

A brief discussion about the process concludes this activity.

Surveys/Assessments

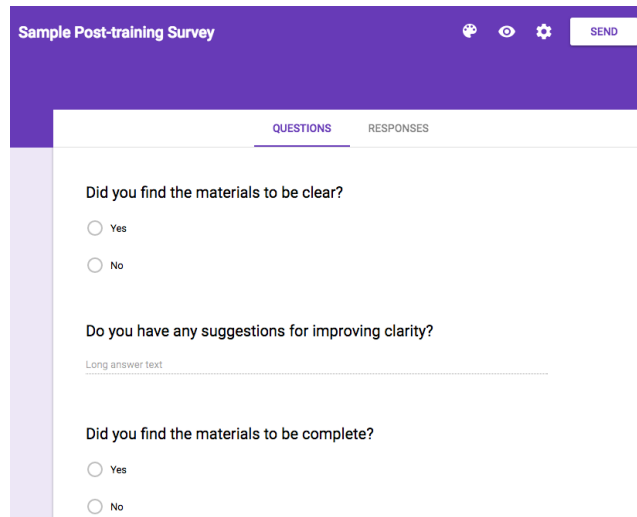
In addition to the survey in Activity - Keychain Assembly, two surveys have been created for this training using Microsoft Word or Google Forms. All surveys are included in the Appendix of Data Collection Instruments.

Survey - Feedback Loop Pre-training

This survey was created to gather information about the learners, to determine if they are regularly updating training documentation and to discover if the training documentation that they are currently using requires improvement.

Survey - Sample Post-training

This survey was created as a resource for the group to use after the completion of this training. This sample will be made available to learners as a Google Form and as a Microsoft Word document.



The screenshot shows a Google Forms interface with a purple header. The title is 'Sample Post-training Survey'. There are icons for help, preview, settings, and a 'SEND' button. Below the header, there are two tabs: 'QUESTIONS' (active) and 'RESPONSES'. The survey contains three questions:

- Did you find the materials to be clear?
 - ☐ Yes
 - ☐ No
- Do you have any suggestions for improving clarity?

Long answer text
- Did you find the materials to be complete?
 - ☐ Yes
 - ☐ No

Image 6: Screenshot of the Survey-Sample Post-training on Google Forms.

feedback loop, a non-functioning box was constructed out of a decommissioned optical light source. With the internals of the original device removed, a small plastic squirrel was placed inside. Rubber flaps at the opening of the device prevents seeing what is inside. A ‘no hands’ icon was created and displayed prominently on the device.

Learners are asked to place their hand in the box. Initial reactions should be at least tentative about the learner’s willingness to put their hand into something that has clear warnings against such actions. With some encouragement, a learner will put their hand in. Subsequent requests of hand insertion to learners that initially resisted will likely be accepted as they have seen their coworker’s hand come out unscathed. This example is then used to construct a memorable feedback loop.

Additionally, a post-training survey based upon Survey - Sample Post-training survey was created in order to gather feedback from learners about their experience with the training. The information gathered in this way may be used to guide training improvement.

Hand Shredder

In order to provide a vivid example of a



Image 7: Non-functioning ‘hand shredder’ device, used to vividly illustrate a feedback loop.

Phase IV: Implementation and Improvement Plan

Implementation

The training materials described above were pilot tested on a group of 6 members of the LCN. A larger group was anticipated, but scheduling conflicts prevented this from manifesting. A pre-training survey was sent out to the group on November 10th, the training was conducted on November 11th and a post-training survey was sent out in the hours following the training event.

The training materials were designed with trainers in mind, but one person that had never conducted training made it into the group. Additionally, one participant did not receive the pre-training survey due to an e-mail addressing mistake and a second participant did not respond. Due to these factors, the pre-training survey contains only 3 responses for the majority of the questions.

The low number of participants able to attend this training (6) relative to the total number of trainers (~25) at the LCN makes it impossible to draw out any statistically significant trends from the surveys and the training. That isn't to say that this training won't have an impact on individuals, but only that it is not possible to statistically quantify the potential impact with any degree of certainty at this time. There are some items of note that may be trends across all trainers in the lab. In order to determine the trends accurately, a survey should be sent out to all lab trainers and not just those that attended the training. In retrospect, this should have been done to begin with. Doing so would have provided valuable metrics for the lab before any to the lab members were exposed to this training.

Pre-training Survey Results

With only 3 trainer responses, there is nothing conclusive to draw from this survey aside that it is inconclusive. Only 2/3 eligible respondents reported that they review materials before using them in training, and only one of the respondents administers post-training surveys. The survey administrator was also the only one that regularly updates training materials, while another respondent only sometimes updates materials. Being able to more readily quantify the responses to these questions across the LCN would provide a better picture of current behaviors as they

pertain to the use and updating of training materials. This information, in turn, can be used to direct further interventions on the topic.

All 3 of eligible respondents did agree that the training materials they use are in need of improvements. This may be at odds with the needs assessment finding that 77% of training materials are adequate. However, needing improvement and being adequate are two different things. Training is being accomplished, so the materials would be adequate to that point. How materials could be improved and to what degree they could be improved is beyond the scope of this survey.

When asked to define a feedback loop, only one out of four respondents correctly identified it as involving observation, learning and improvement or some variation thereof. Other respondents made references to chains of human communication.

When asked what kept respondents from updating materials, two interesting ideas emerged:

- Not knowing what within the documentation should be improved.
- Treating training purely as a training event, which is detached from any potential changes to the related documentation.

The first idea suggests a lack of skills that can be used to determine where training materials are working and where they are not. The second problem suggests an attitudinal problem in which training and training design cannot influence one another.

As designed, the intervention attempts to address both of these problems.

Training Notes

Notes were taken while training was being conducted. In this way, the note taking was a demonstration of how this practice can be done without detracting from the training. The content was well received, there was good learner interaction, demonstrations and activities functioned as designed and the duration did not exceed the time allotted. The content was well suited to the audience and it was presented in an engaging way so as to keep learners present at all times.

There were a few inconsistencies in the materials that were discovered along with a few items that could be easily improved, such as providing instruction on the use of adjustable pliers. The issues discovered during the training were minor and are the types of issues that are to be expected when piloting a new training module.

Complete training notes are located in Appendix C - Feedback (Training Notes).

Process Improvements

The product of the intervention's activity was a draft of an improved version of the process that was provided. The image below shows the provided instructions and the much-expanded draft side-by-side.

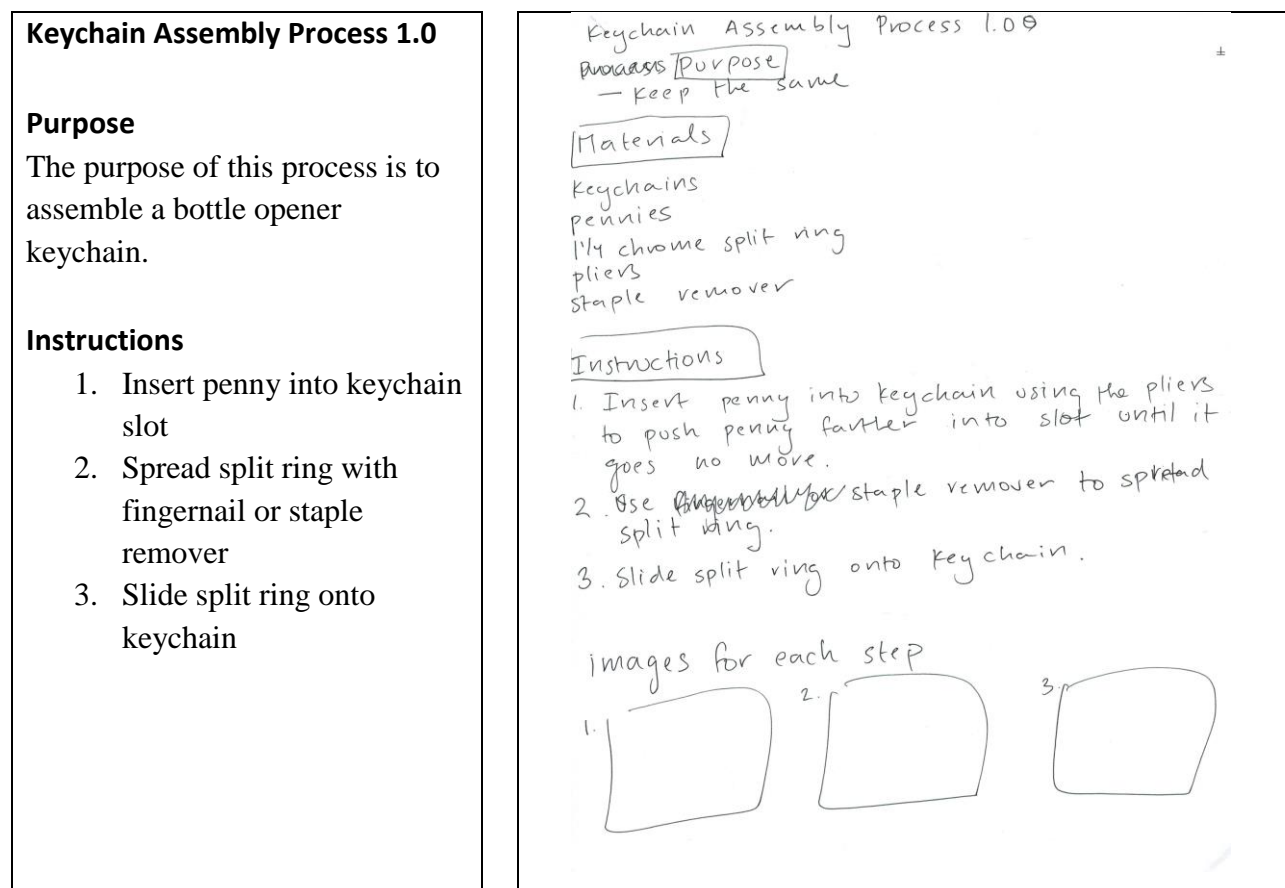


Image 8: Minimal instructions for a process to assemble keychains that were provided on the left with a learner produced draft version on the right.

Note: The process title pictured in the above image differs from how the process is referred to elsewhere in this paper as the process title has since been changed to comply with new document naming standards.

Post-training Survey Results

Of the 6 pilot training attendees, all 6 responded to a post-training survey (Survey - Sample Post-training). This data is therefore completely representative of the pilot group, but still not statistically representative of all lab trainers.

With minor exceptions, respondents found the material to be clear, complete, consistent and concise.

The activities were found to support the objectives, were understandable, well thought out and well timed.

The materials were found to be well prepared and to contain visuals that reinforced the spoken content.

Open-ended questions provided a number of responses that fall under the categories of problems, suggestions, requests and general comments.

Complete training responses are located in Appendix C - Feedback (Training Responses).

Improvement Plan

In order to integrate the training notes and feedback generated through the implementation of this training event, the following steps should be taken to immediately improve the training:

- Fix the wording of questions in the Survey - Keychain Assembly.
Send the pre-training survey to all lab trainers in order to obtain accurate baseline data regarding this intervention.
- Revise Activity- Keychain Assembly so that the review portion is skipped.
 - This will need to be explained at the start of the activity.
- Revise materials for consistent use of process and procedure.
- Update Worksheet - Training Improvement to include a training completion record sheet on the back.

Additionally, the creation of a style guide would greatly help facilitate the discussion in Section 3. Work on the style guide has begun, but its completion will require the creation and coordination of a small work group in order to ensure that the guide covers all common documentation scenarios. This final presentation section will also greatly benefit from a document audit and organization that is planned for 2017.

While the use of text was minimal compared to what is normal for this group, the removal of additional text is possible. When lab members become more accustomed to presentations containing a larger image to text ratio, the impact of this presentation could be improved by increasing the number of images while decreasing the amount of text.

Phase V: Evaluation

Evaluation Plan

In order to assess the effectiveness of the training on Kirkpatrick's 3rd stage of learning, behavior, the questions asked in Survey - Feedback Loop Pre-training shall be asked of learners after a period of 3 months. These results will be compared to those from the pre-training survey in order to see if behaviors regarding updating training materials have changed.

The assessment of the effectiveness of the training on Kirkpatrick's 4th stage of learning, results, requires a different approach. The overall organizational goal that this training is attempting to address is to increase the frequency that training materials are updated. Within the presentation, a process of creating an archive folder in order to store older versions of the document that is being updated was described. An initial increase in the number of archive folders on the Nelson Lab's shared server will indicate that training documents are being updated.

Additionally, the practice of adding and incrementing version numbers to documents was introduced. The presence of multiple versions of a document within an archive folder will also signify a desired result. An audit of all Nelson Lab documents is planned for 2017, but a simple search for archive folders will be sufficient to determine if the new practices are being adopted.

In order to evaluate the quality of the improvements being made, a subset of documents with newly created archive folders should be inspected and a copy of the oldest and newest documentation should be compared. In the event that changes do not contribute towards improving the documentation, re-evaluation of the intervention will be required.

It is recommended that searching for archive folders and additional document versions be done quarterly and the results be tabulated and graphed in order to identify any training material improvement trends that emerge and to design and implement appropriate interventions as necessary in order to maintain sustained iterative documentation improvements.

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Appendix A - Data Collection Instruments

Questions - Stakeholder Interview 1.2

1. What does your current training plan look like for new lab members?
2. Undergraduate Students
 - a. Why do we take in undergraduate students?
 - b. How do we benefit from taking in undergraduate students?
 - c. How is the number of undergraduate students we take in determined?
 - d. What is the training plan for incoming undergraduate students?
 - e. Who conducts undergraduate student trainings?
 - f. Is there any special administrative paperwork required for this type of lab member?
 - g. How many hours per week do undergraduate students work?
3. International Visitors
 - a. Why do we take in international visitors?
 - b. How do we benefit from taking in international visitors?
 - c. How is the number of international visitors we take in determined?
 - d. What is the training plan for incoming international visitors?
 - e. Who conducts international visitor trainings?
 - f. Is there any special administrative paperwork required for this type of lab member?
 - g. How many hours per week do international visitors work?
4. Do you have any additional thoughts on the matter of training within the LCN that you would like considered?

Survey - Nelson Lab Training 1.3

Basic Information

Just a few questions about you and what you do in the Nelson Lab.

What is your role? Post Doc/Staff/Research Assistant/Other

How long have you been in the Nelson Lab? 0-3 months/4-6 months/7months to 1 year/Longer than 1 year

General Training Questions

What is your opinion towards using time BEING TRAINED within the Nelson Lab?

What is your opinion towards using time TRAIN OTHERS within the Nelson Lab?

What is your opinion towards using time CREATING TRAINING MATERIALS within the Nelson Lab?

Are the training materials that you have used in the Nelson Lab adequate? Yes/No

Was a training plan used with you when you first joined the Nelson Lab? Yes/No/I don't remember

Have you received adequate training for all aspects of your position? Yes/No

Are there some aspects of your position on which you feel that you could benefit from ADDITIONAL training? Yes/No/N/A

If you feel you could benefit from additional training, in what training topics would you be interested?

Are there some aspects of your position on which you feel that you could benefit from REFRESHER training? Yes/No/N/A

If you feel that you could benefit from refresher training, in what training topics would you be interested?

Have you conducted any trainings in the past 6 months? Yes/No

Which trainings have you conducted?

Select a training that you have conducted in the past 6 months and click 'continue'.

You will be asked a series of questions specific to that training and then you will return to this page so that you may provide feedback regarding additional training topics

When you have responded to all of the applicable training topics, select 'No More Trainings Apply To Me' and click 'continue'.

NOTE: If you have conducted more than 5 types of training in the past 5 months, please provide feedback to the 4 most recent trainings that you have conducted.

Data Management	Net Station Acquisition	Redcap Data Entry
EEG Data Processing	Net Cleaning	Tobii Studio Acquisition
ERP Data Processing	NIRS Acquisition	Video Coding
E-Prime Acquisition	NIRS Data Processing	Visit Scheduling
Net Application	Onboarding	No More Trainings Apply To Me

Training Specific Questions

Think back to the past 6 months and answer the questions below regarding conducting TRAINING TOPIC training as honestly and as accurately as you can.

What Resources are required for this training?

If any of the resources required for this training were difficult to secure, please list them.

Could this training accommodate more than one learner at a time? Yes/No

How many people did you train the last time that you conducted this training?

Are there adequate materials for this training such as training outlines, examples and checklists?
Yes/No

Have you created materials for this training? Yes/No

If you have created training materials, do lab members other than those you've trained know of their existence? Yes/No/NA

If you have created materials, are they available on the public lab server? Yes/No/NA

Do you feel that the current approach for this training is effective?
Yes/No

What, if anything, do you believe could be done to improve the effectiveness of this training?

Final Thoughts

If you have any additional thoughts regarding the current and future state of training in the Nelson Lab, please include them below.

Survey - Feedback Loop Pre-training 1.1

Without looking it up, please describe a feedback loop. It's OK if you don't know what it is.

Prior to conducting a training event, how much time do you take to review materials? Yes/No

While conducting a training event, do you take notes as to how the materials might be improved?

Yes/No

Do the materials for trainings you conduct need improvement? Yes/No

After a training event, do you update training materials based upon the feedback you receive?

Yes/No

If there are materials that need improvement and you haven't improved them, please state what has kept you from improving them.

Survey - Sample Post-training 1.0

Were the training objectives stated clearly?

Were the materials?

Clear _____How would you improve the clarity of this document?

Complete _____Was there anything missing from this document?

Concise _____How would you make this document more concise?

Consistent _____Where can consistency of this document be improved?

Did the activities contribute towards meeting the training objectives? Yes/No

Did the activities deepen your understanding of the materials? Yes/No

Were the activities well thought out? Yes/No

Did there seem to be adequate time allotted for the activities? Yes/No

Do you have any suggestions for improving the activities?

Did the presenter know the content well? Yes/No

Did the presenter seem well prepared to conduct this training? Yes/No

Did the presentation flow well from one topic to the next? Yes/No

Did the visuals utilized reinforce the concepts presented? Yes/No

Is there anything that you would change about the presentation of these materials?

How would you improve this training?

Appendix B - Instructional Materials

Presentation- Exploring How We Update Training Materials 1.0

Exploring How We Update Training Materials

with Graham Holt

- Theory
- Practice
- Resources and LCN Specifics

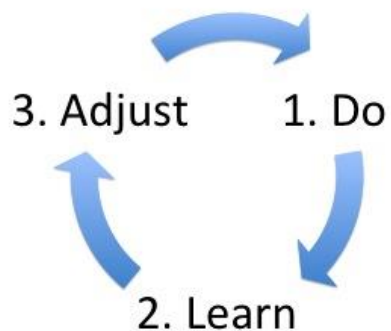
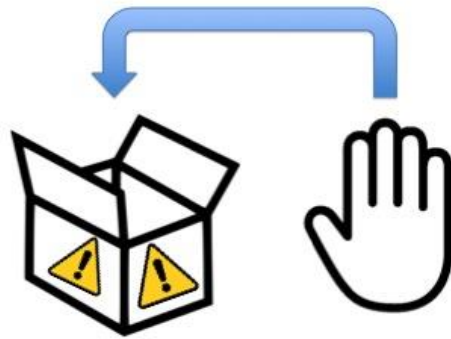
Training Feedback Loops

Section 1: Theory

Objective:

- Explain Feedback Loops

What Just Happened?



Feedback Cycle (loop)

Feedback Loop Examples

If it's cold in the room.

1. Adjust thermostat
2. Observe result
3. Adjust approach for next time

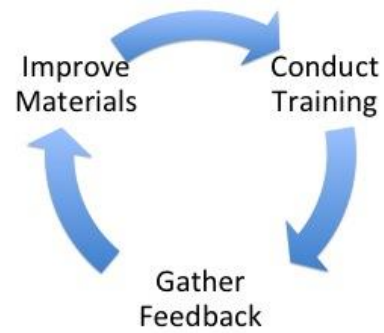
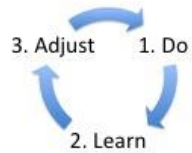


More Feedback Loops

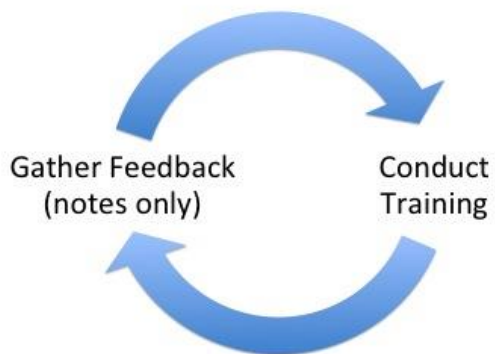
Topic:

What are some examples of feedback loops?

You have 3 minutes!



Training Feedback Loop



Training Feedback Loop



4 Cs of Improvement

Clear
Complete
Consistent
Concise

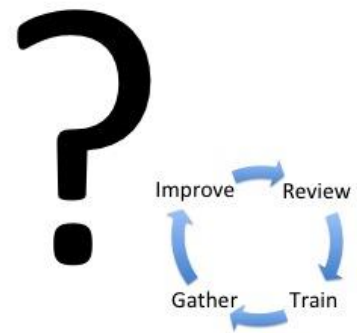




Is there extra information that really isn't needed to complete the task?

Is unnecessary information included?

Information included?



Training Feedback Loops

Section 2: Practice

Objectives:

- Review Training Materials
- Capture Feedback
- Improve Documentation

Keychain Assembly Training



Review- Read through the procedure.

Train- Use the procedure and take notes.

Gather- Answer survey individually and compare.

Improve- Create revised document draft.

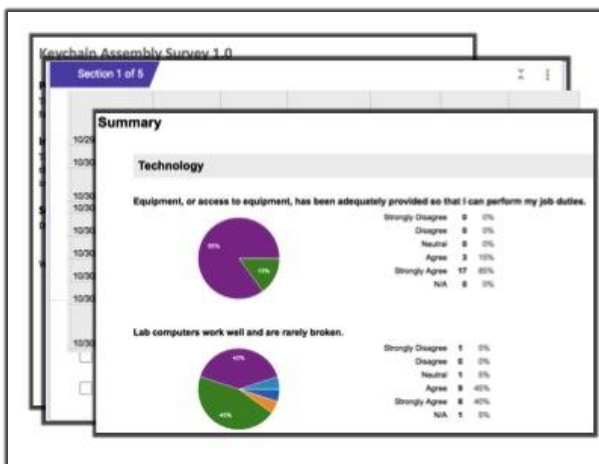


Training Feedback Loops

Section 3: Resources and LCN Specifics

Objectives:

- Share Survey Templates
- Explore Worksheet Additions
- Discuss Document Style



Training Improvement Worksheet 0.2.9_8

Review/Prepare

- Gather and Locate Training Materials
- Training Document (Standards, Instructions, etc.)
- Physical Materials
- Review Training Materials
- Read Through Materials for Consistency
- Note Potential Feedback/Issues

Train

- Conduct Training/On-the-job Learning
- Deliverables

Collect

- Administer Post-training Survey
- Examine Data for Trends and Opportunities

Improve

Evaluate

- Evaluate Improvement Ideas From:
 - Review/Preparation
 - Training Notes
 - Survey Results
- Consult With Subject Experts Regarding Changes
- Pick the Best Ideas

Draft

- Sketch New Document Version
 - Review With Subject Expert
- Modify Copy of Source Document With Changes
 - Update Formatting (if needed)
 - Increment Version Number
 - Review With Subject Expert

Distribute

- Archive Source Document
- Replace Source Document With New Document
- Announce Changes To Appropriate Distribution Lists

Improve- Evaluate

- ☐ Consult With Subject Experts

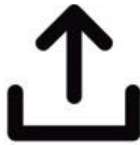
Improve- Draft

- ☐ Sketch Document
 - ☐ Review With Subject Expert
- ☐ Modify Copy of Document
 - ☐ Review With Subject Expert

Improve- Distribute



Archive



Upload



Announce

3

Document Style Guide

Calibri

Times

~~Comic Sans~~

0.6_d

1.3

v1.3

Keychain_Survey_1.0

KeychainSurvey1.0

Keychain Survey 1.0



Thank You

Survey Template and Worksheet Location:
DMC_LCN_Admin/Training Resources



Activity - Keychain Assembly 1.1

About This Exercise

This exercise was designed as part of the Exploring Training Feedback Loops Project prepared for the Laboratories of Cognitive Neuroscience at Boston Children's Hospital. The project utilizing this activity is a final project presented to the faculty of the University of Massachusetts at Boston as a requirement of the Instructional Design Master's Degree Program.

Prelude

Improving training documentation should be an iterative process. Sometimes documentation is in a pretty rough state, but each time you use it, there is an opportunity for improvement.

Purpose

The purpose of this exercise is to allow learners to gain first hand experience in the process of iterative documentation improvement. This activity will also provide learners an opportunity to become familiar with the use of an assembly process, worksheet and post-training survey (included at the end of this document).

Equipment

Consumables

- Split Rings (keychain rings)- 3 per participant
- 3D Printed Key Chains (<http://www.thingiverse.com/thing:1870537>) - 3 per participant
- Pennies- 3 per participant
- Blank Paper- 3 sheets per participant
- Pens/Pencils- 1 per participant
- Training Improvement Worksheets- 1 per group
- Keychain Assembly Process- 1 per group
- Post-training Survey- 1 per participant

Tools

- Pliers- 1 pair per 3 participants
- Staple Removers- 1 per 3 participants
- Time keeping device
- Table

Preparation

Gather All Materials

Ensure that there are adequate supplies for each participant with some extras available.

- Using a 3D printer, print out keychain bottle openers well ahead of the training event.

- Print adequate copies of the following documents:
 - Post-training Survey
 - Keychain Assembly Process
 - Training Improvement Worksheet.
- Gather remaining items.

In the event that you cannot locate an enough pliers for your training group, you can always use the aforementioned 3D printer to print some out

(<https://www.thingiverse.com/thing:139589>).

Arrange Materials

Materials will need to be placed in a central location in the training room so that all groups may access them. Ideally, the materials will be laid out prior to starting and covered with a cloth of some sort. Alternately, a shallow lidded box can be used to contain materials and conceal them until they are needed.

Activity

Exposition

Sample Script:

We've just learned about the theory of how feedback loops work in training, but theory is boring, let's jump in and try it out. We're going to break into groups and go through the process of reviewing documentation, using it, gather information and then improve upon the document.

Break out students randomly into groups of 3 or 4 using the group breakout technique of your choosing.

Under this cloth (or in this box) I have everything that you need, but we'll start with the instruction document and worksheet. Work through the steps and and see what kind of improvements that you can make.

Hand out instructions and worksheet.

We'll have about 20 minutes for this activity, and I'll give you updates as we go along. If you end up running short on time to make your improvements, you can make a list of improvements that you would make and that will work.

If you have any questions about the process or the procedure, please ask me and I will clarify the situation.

Make all materials available.

Group Work Timeline

It should be noted that the following times are estimates that will need to be adjusted during the activity based upon the progress of the groups.

Time should be noted aloud at the following points:

5 minutes- You should be done with your review of materials and on to using the procedure.

10 minutes- We are half way through. You should have finished using the procedure and be filling out your surveys and reviewing your feedback to come up with an improvement plan.

15 minutes- You have 5 minutes left. You should be working on revising the instructions now.

18 minutes- Two minute warning. Put the finishing touches on your procedures or make notes

as to the changes you want to make.

20 minutes- That's time, do you guys need two more minutes? (Let them keep working a bit if

they are being productive, otherwise cut the activity here.

Post-activity Discussion Questions

Time: 3-5 minutes

What did you guys think of the process we just went through?

- Was it awkward?
- Were the notes and surveys useful in revising the documentation?

(Time permitting bonus sharing) Each group- Share one improvement that you made to the documentation?

Process - Keychain Assembly 1.0**Purpose**

The purpose of this process is to assemble a bottle opener keychain.

Instructions

1. Insert penny into keychain slot
2. Spread split ring with fingernail or staple remover
3. Slide split ring onto keychain

Survey - Post-training 1.0

Purpose

To evaluate your experience in utilizing the Keychain Assembly Process 1.0 in order to improve it in the future.

Instructions

Take this survey individually and then compare notes with your group when you have all completed the survey. The survey will only take a few minutes to complete, but should provide your group with information that can be used to improve your version of the documentation.

Survey Questions

Did you have any difficulties in completing the task? If so, what were they?

Were the instructions:

Clear? _____ Can clarity be improved?

Complete? _____ Is there anything missing from this document?

Concise? _____ Can the document become more concise?

Consistent? _____ Are styling and wording and consistent?

What do you like best about this document?

What do you like least about this document?

If you could add one thing to this document, what would it be?

Worksheet - Training Improvement (short) 1.0

Review/Prepare

- ☐ Gather and Locate Training Materials
 - ☐ Training Document (handouts, instructions, etc.)
 - ☐ Physical Materials
- ☐ Review Training Materials
 - ☐ Read Through Materials for Comprehension
 - ☐ Note Potential Problem Areas Below

Potential Problem Areas:

Train

- ☐ Conduct Training/Self Directed Learning
 - ☐ Take Notes

Notes:

Collect

- ☐ Administer Post-training Survey
- ☐ Examine Data For Trends and Opportunities

Improve

- ☐ Evaluate Improvement Ideas From:
 - ☐ Review/Preparation
 - ☐ Training Notes
 - ☐ Survey Results
- ☐ Pick the Best Ideas
- ☐ Sketch New Document Version

Worksheet - Training Improvement 1.0

Review/Prepare

- ☐ Gather and Locate Training Materials
 - ☐ Training Document (handouts, instructions, etc.)
 - ☐ Physical Materials
- ☐ Review Training Materials
 - ☐ Read Through Materials for Comprehension
 - ☐ Note Potential Problem Areas Below

Potential Problem Areas:

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- ☐ Conduct Training/Self Directed Learning
 - ☐ Take Notes

Notes:

Collect

- ☐ Administer Post-training Survey
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Improve

Evaluate

- ☐ Evaluate Improvement Ideas From:
 - ☐ Review/Preparation
 - ☐ Training Notes
 - ☐ Survey Results
- ☐ Consult With Subject Experts Regarding Changes
- ☐ Pick the Best Ideas

Draft

- ☐ Sketch New Document Version
 - ☐ Review With Subject Expert
- ☐ Modify Copy of Source Document With Changes
 - ☐ Update Formatting (if needed)
 - ☐ Increment Version Number
 - ☐ Review With Subject Expert

Distribute

- ☐ Archive Source Document
- ☐ Replace Source Document With New Document
- ☐ Review With Subject Expert
- ☐ Announce Changes To Appropriate Distribution Lists

Appendix C - Feedback**Training Notes**

Introduction/Section 1

- Hand shredder feedback look demonstration was extremely well received.
 - Reactions were as hoped for with the exception of one learner who refused to insert her hand.
 - Abstainer from exercise was still valuable as it illustrates that each person reacts differently to stimuli.
- 3 minutes may be too long for groups to discuss examples, cut off at 2 minutes.

Practice/Section 2

- The use of the worksheet was not made clear in the instructions. Perhaps ‘meta’ instructions are needed.
- Initially broken into a group of 2 and a group of 3, the groups quickly merged into a large group of 5, which became 6 with the addition of a latecomer.
This group worked very well together during this exercise.
- Some users did not know how to use a pair of pliers.
A brief introduction to the tool and safety information should be provided
- Presentation and documents were not consistent with the use of the terms process vs. procedure.
- Footer information in provided documents was well received.
- A dedicated feedback space on training documentation was suggested.
 - This could be on the document itself.
 - This could be on the back of Worksheet- Training Improvement.
- Keychain Assembly Survey 1.0 contains older versions of the 4 C questions.

- Activity ran a little long, allow for 10 minutes to do the redesign instead of 5.

Lab Specifics/Section 3

- Zooming animation was well received.
- Group liked the idea of a style guide and had never thought of creating one.
- Group craved more details than there were to provide.
- Proposed changes were well received, and bode well for their future implementation.

Upon completing the training, one learner noted that their attitude towards training had been completely shifted as they had previously been focusing on training and had not been taking notes or even thinking about improving the documentation when in ‘training mode’.

Training Feedback

Problems

- Survey- Keychain Assembly has incorrectly worded questions.
- Pre-training survey didn’t work for non-trainers.
- Review and design phases appeared to be very similar in their outcome.

Suggestions

- Include more information about implementation across the lab.
- Provide digital resources so that someone with a laptop can actually build out a new procedure.
- Consider interjecting more to keep group on task.

Requests

- Please create a follow-up training using an actual lab document and work on it together as a group.

Comments

- This was a good exercise to take a seemingly simple procedure and realize how you can still provide lots of feedback.
- This 90-minute training did not seem that long due to the combination of presented and hands-on learning.