

More than Textbooks...

Making Assessment Affordable

April 6, 2026
Justin M. Shorb



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Introduction: Justin M. Shorb, Ph.D.

Director of Curriculum Innovation and Development



B.A. Mathematics & B.S. Chemistry – Hope College, Michigan
Ph.D. Chemistry – University of Wisconsin—Madison

Development and implementation of an empirical frequency map for use in MD simulations of isotope-edited proteins, and, Development, implementation, and evaluation of an online student portal as a textbook replacement in an advanced general chemistry course

Computational Theoretical Biophysical Chemistry and Chemistry Education Research

Professor at:



jshorb@libretexts.org

Introduction: Justin M. Shorb, Ph.D.

Director of Curriculum Innovation and Development



Curriculum Assessment, Design, Grant-Writing, Eye-Tracking Research, Multimodal Education, Online Textbook Design

Fields of Undergraduate Mentees: Chemistry, Biology, Mathematics, Computer Science, Engineering, Dance, Creative Writing, Pre-Ophthalmology

Ed Tech: ChemEd DL, NSDL, Catalyst Education (LabFlow), LibreTexts



WISCONSIN
UNIVERSITY OF WISCONSIN-MADISON

jshorb@libretexts.org



The Faces of the LibreTexts Team



Justin M. Shorb, Ph.D.

Director of Curriculum Development and Innovation



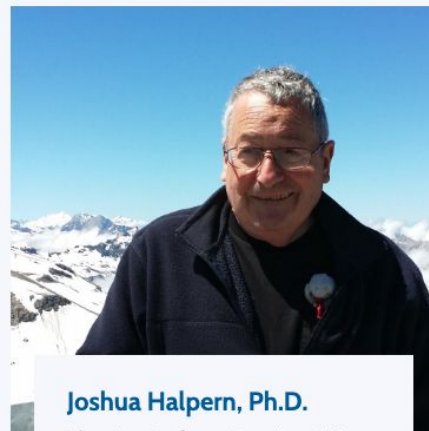
Benny the Owl

Director of Benefits



Delmar Larsen, Ph.D.

Chemistry Professor, Founder



Joshua Halpern, Ph.D.

Chemistry Professor Emeritus, CEO



Jennifer Rogers, MA, MLS

Director of Outreach, Engagement, and Development



Plus all of the behind the scenes magic-makers!



LibreTexts → The *LibreVerse*



Delmar Larsen, Ph.D.

Chemistry Professor, Founder

UC DAVIS
CHEMWiki



Chemistry
Chemistry OER





LibreTexts → The *LibreVerse*



Delmar Larsen, Ph.D.

Chemistry Professor, Founder



To Fully Replace
for-profit publisher
model, LibreTexts
must be **more than**
just OER **Books**.





Getting Started: LibreTexts Launchpad

Your LibreVerse

Access all of your LibreTexts applications from one place. Applications with a tool icon have not yet been integrated with LibreOne sign-on.

 Academy Online Professional Development for Instructional Staff	 ADAPT The Adaptive Learning Assessment System	 Commons Our central catalog of curated Open Educational Resources	 Conductor Manage your OER projects.	 Connections Connect and converse with fellow instructors and OER authors.	 Forge An integrity-enhanced word processor and learning management system.	 Jupyter Create interactive notebooks with code and visualizations	 Nova The open course builder (coming soon)	 Store Order print copies of textbooks, application access codes, LibreTexts swag, and more.	 Studio Create and share H5P interactive activities	 Support Center All of your LibreTexts questions, answered.
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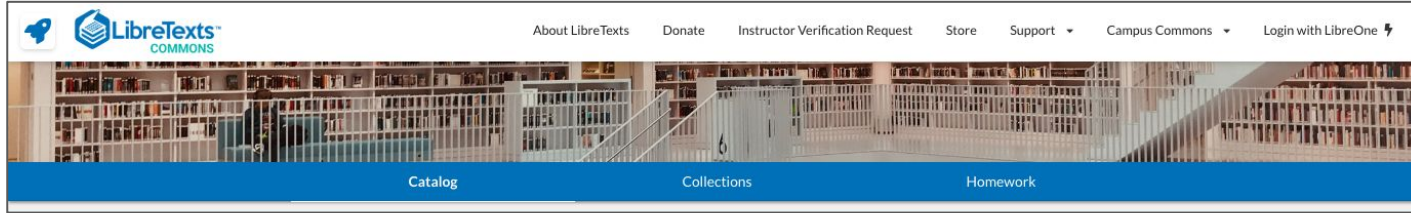
Libraries

All accounts have access to view the LibreTexts libraries. Instructors who wish to create or edit content on the libraries may need to [request access](#). Libraries you have edit access to will be denoted with a key icon.


 Biology Biology OER	 Business Business OER	 Chemistry Chemistry OER	 Engineering Engineering OER	 Español OER en español	 Geosciences Geology OER	 Global OER in languages around the world	 Humanities Humanities OER	 K-12 Education OER for K-12 education	 Mathematics Mathematics OER	 Health Medicine and Health OER
 Physics Physics OER	 Social Sciences Social Sciences OER	 Statistics Statistics OER	 Ukrayinska українською мовою	 Workforce Workforce and trade education OER	 Development Site LibreTexts Development Library					



The LibreTexts Commons Catalog



 **Books** 3446 

 Library

Total Books: 3475

Biology: 203

Business: 237

Chemistry: 523

Engineering: 144

Español: 16

Geosciences: 80

Humanities: 706

K-12: 22

Mathematics: 402

Medicine: 179

Physics: 135

Social Sciences: 605

Statistics: 90

Workforce: 133



LibreVerse Platforms: Assessments in **bold**



Academy Online
Professional Development for
Instructional Staff



ADAPT
The Adaptive Learning
Assessment System



LibreTexts
COMMONS
Our central catalog of curated
Open Educational Resources



LibreTexts
CONDUCTOR
Manage your OER projects.



Connections
Connect and converse with
fellow instructors and OER
authors.



Forge
An integrity-enhanced word
processor and learning
management system.



Jupyter
Create interactive notebooks
with code and visualizations



COMING 2025
LibreTexts
NOVA
The open course builder
(coming soon)



LibreTexts
Store
Order print copies of textbooks,
application access codes,
LibreTexts swag, and more.



LibreTexts
STUDIO
Create and share H5P
interactive activities



LibreTexts
Support Center
All of your LibreTexts questions,
answered.

- Academy Online - Professional Development Courses for Faculty
- **ADAPT** – Homework & Assessment
- Connections – Forum for OER
- **Forge** – Writing Analytics & Assessment
- **Jupyter** – Embedded Data & Coding
- Store – Print Books, Access Codes
- Studio – H5P Authoring & Database
- Support Center



LibreVerse Assessment: ADAPT – Homework & Assessment



- 300,000+ Open Content Questions in QBank
- LTI & API access for customized interaction with Campus
- Full Course Management System Capabilities
- Audio & Video Discussions, Molecule Structures, Long-form Writing
- Learning Trees: Interactive branched tutorials with grades
- Accessible by initial design
- Alignment to Frameworks, Question Customization



WebWork

WebWork is an online homework delivery system primarily used for mathematics and science.



IMathAS

IMathAS is a primarily web-based math assessment tool for delivery and automatic grading of math homework and tests.



H5P

H5P is a free and open-source content collaboration framework based on Javascript.



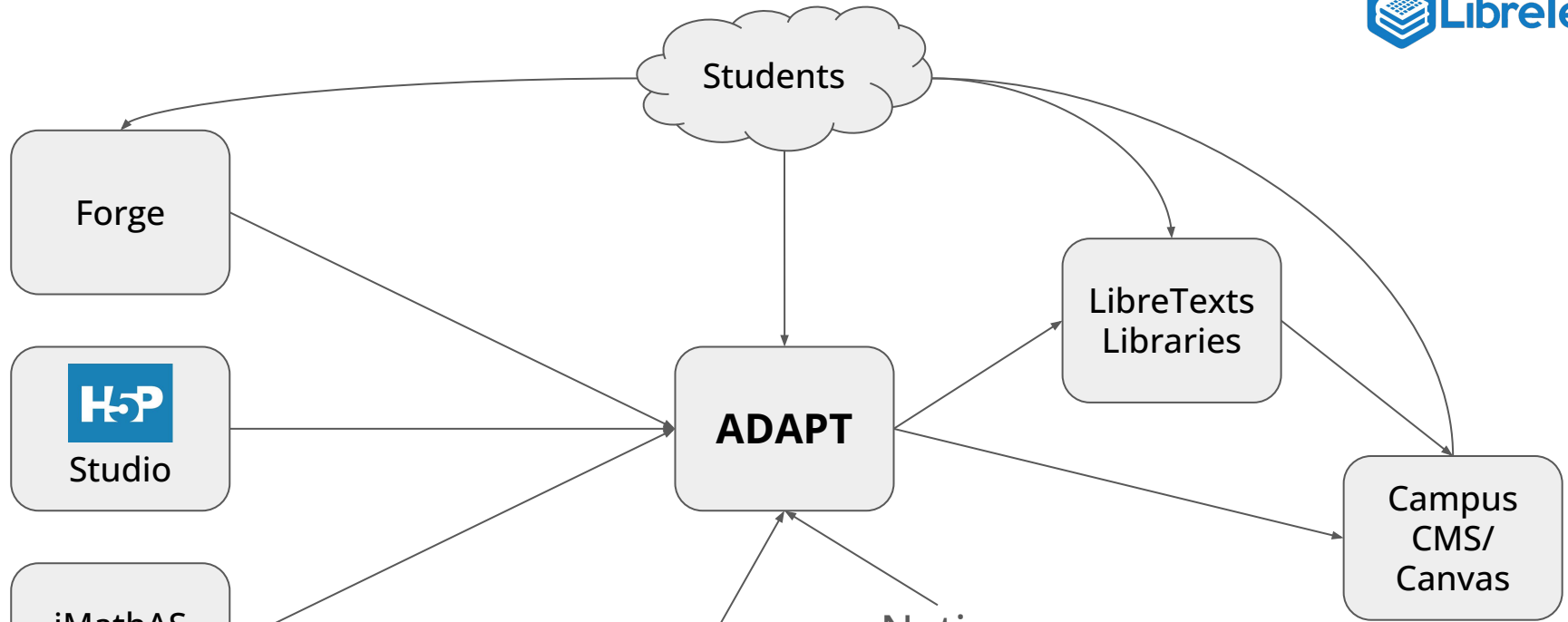
Open Source solutions to Open Education Assessment Needs:

NUMBAS *my*OpenMath  WeBWork


Prairie
Learn



Math/
Science



myOpenMath



Native:

- Basic QTI (Canvas, other LMS)
- Sketcher (chemistry structures)
- Discuss-It (threaded audio/visual/text discussions)
- ADAPTable growth!

Content ?

Both blocks are rendered in problem to students.

HTML Block ? ▶

Auto-Grade Tech Block ▼

Existing ?

None ▾

New ?

✓ None

Native

WeBWork

IMathAS

Content ?

Both blocks are rendered in problem to students.

HTML Block ? ▶

Auto-Grade Tech Block ▼

Existing ?

None ▾

New ?

Native ▾

Native Question Type

Basic (QTI) ?

Nursing ?

Sketcher

Discuss-it ?

All

Multiple Choice

True/False

Numerical

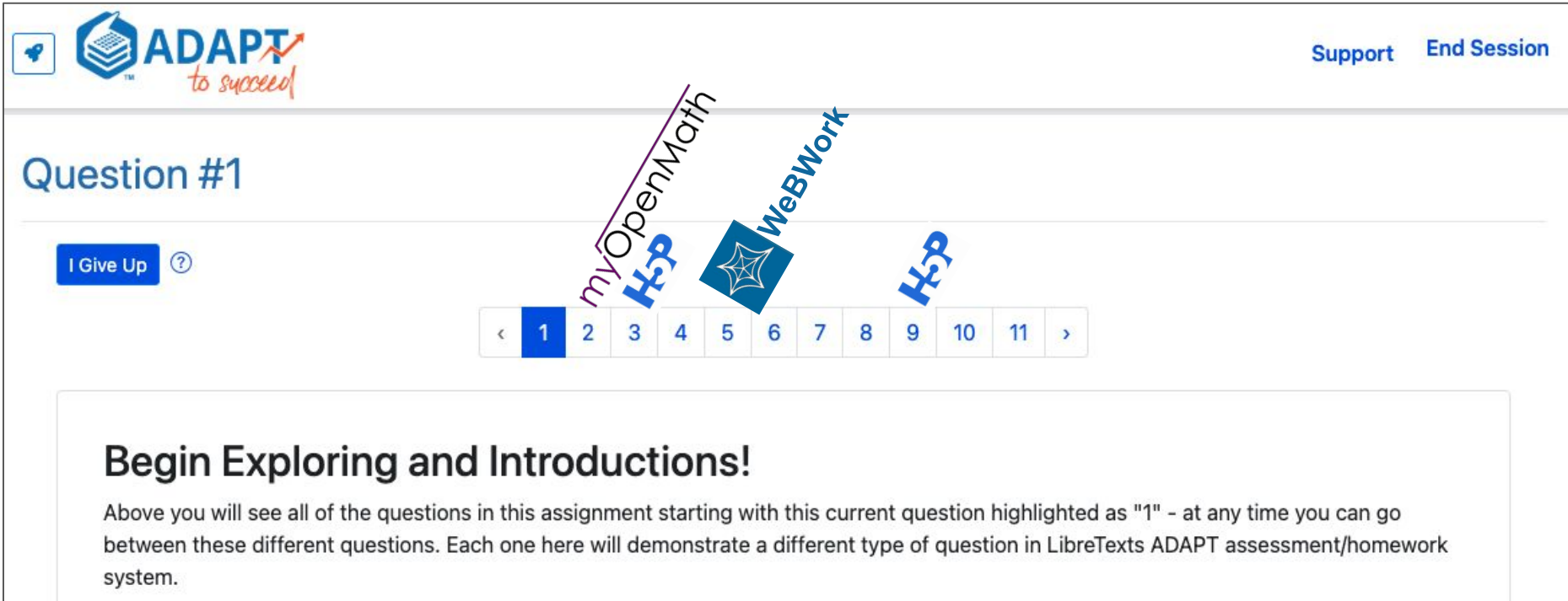
Multiple Answer

Fill-in-the-blank

Select Choice

Matching

Students



The screenshot shows the ADAPT assessment interface. At the top left is the ADAPT logo with the tagline "to succeed". At the top right are "Support" and "End Session" links. The main heading is "Question #1". Below this is a navigation bar with a "Give Up" button and a question indicator showing "1" highlighted. A series of question numbers from 1 to 11 are displayed in a row, with "1" highlighted. Overlaid on the interface are three logos: "myOpenMath" (purple text), "H&P" (blue text), and "WeBWork" (blue text with a star icon).

ADAPT
to succeed

Support End Session

Question #1


I Give Up ?

< 1 2 3 4 5 6 7 8 9 10 11 >

Begin Exploring and Introductions!

Above you will see all of the questions in this assignment starting with this current question highlighted as "1" - at any time you can go between these different questions. Each one here will demonstrate a different type of question in LibreTexts ADAPT assessment/homework system.

Let's Explore ADAPT!




Question #1

[I Give Up](#) ?

Begin Exploring and Introductions!

Above you will see all of the questions in this assignment starting with this current question highlighted as "1" - at any time you can go between these different questions. Each one here will demonstrate a different type of question in LibreTexts ADAPT assessment/homework system.

<https://adapt.libretexts.org/students/assignments/125249/init-formative>



















Introduction to ADAPT

[Support](#) [End Session](#)

My Courses

[New Course](#)
[Import Course](#)

Course	Shown ?	Term	Actions
☰ Introduction to ADAPT Homework	<input type="checkbox"/> No	N/A	   
☰ Organic Chemistry (OpenStax) Native Import	<input type="checkbox"/> No	N/A	   
☰ Spanish 1 (Tarea Libre) Import	<input type="checkbox"/> No	Fall 23	   
☰ Demo - Formative	<input type="checkbox"/> No	N/A	   

ADAPT as an OER Question Library

(as of April 16,2025)

ADAPT Library: 262,486 questions

- **H5P: 25,502 questions**
- **WeBWork: 54,152 questions**
- **MyOpenMath/iMathAS: 72,894 questions**
- **Open-Ended: 70,362 questions**
- **ADAPT Native Technology: 37,217 questions**
 - Basic QTI (Canvas-like): 19,451 questions
 - Nursing (NCLEX prep): 17,113 questions
 - Sketcher (molecular structures): 438 questions
 - Discuss-It (Threaded Audio/Visual): 215 questions



ADAPT as an OER Question Library

ADAPT Library: 310,127 questions

- **H5P: 28,000+ questions**
- **WeBWork: 56,000+ questions**
- **MyOpenMath/iMathAS: 73,000+ questions**
- **Open-Ended: 72,000+ questions**
- **ADAPT Native Technology: 100,000+ questions**
 - Basic QTI (Canvas-like): 46,000+ questions
 - Nursing (NCLEX prep): 17,113+ questions
 - Sketcher (molecular structures): 3391 questions
 - Discuss-It (Threaded Audio/Visual): 556 questions



Default Auto-Release ?

Assignments will be shown the specified amount of time **before** your first "available on". Scores, solutions, and statistics will be released the specified amount of time **after** your last due date or final submission date if applicable.

Item	Time frame	Condition
Assignment	Ex. 2 days/3 hours <input type="button" value="Clear"/>	before your "available on"
Scores	<input type="text"/> <input type="button" value="Clear"/>	<input checked="" type="checkbox"/> Please choose an option after your "due date"
Solutions	<input type="text"/> <input type="button" value="Clear"/>	after your "final submission deadline" (if applicable)
Statistics	<input type="text"/> <input type="button" value="Clear"/>	Please choose an option

Shift Dates

- Provide a new First Available On and shift all other assignments based on the difference between the two Available Ons
- A period of time such as 1 hour or -10 days
- Provide a single common date for the Available On, the Due Date, or the Final Submission

First Available On

No date selected

Name	Available On	Due Date	Final Submission Deadline
Introduction to ADAPT	Wed, 4/16/25 7:37 PM	Wed, 4/16/25 7:37 PM	N/A

Assignment Properties

The fields marked with an asterisk are required.

Formative URL ?

<https://adapt.libretexts.org/students/assignments/125249/init-formative>

QR Code ?



Name*

Introduction to ADAPT

Public Description ?

Course for use in training how to use ADAPT

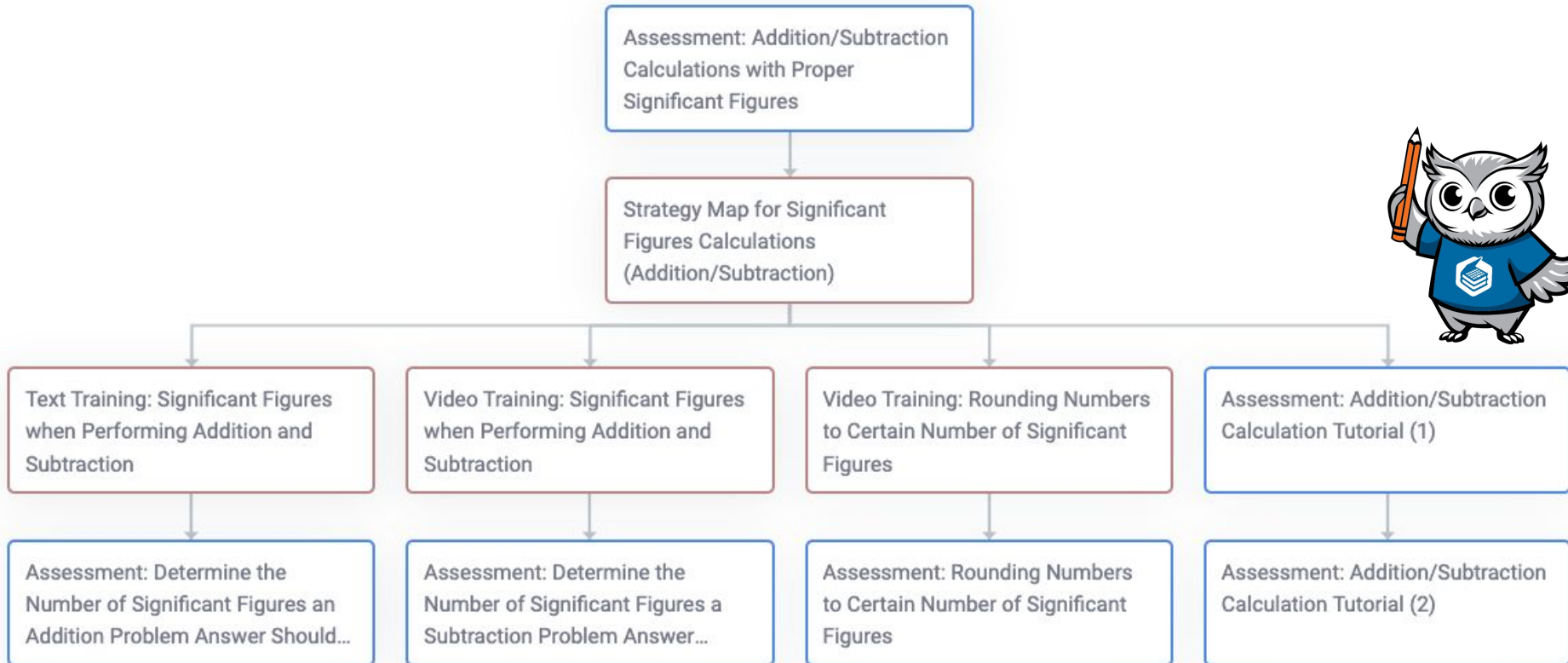
Private Description ?

Developed for Basics for Beginners Webinar 04/2025

Algorithmic* ?

- Yes
- No

ADAPT Native Question Types: Learning Trees



ADAPT Native Question Types: Discuss-It Asynchronous Threaded Text/Audio/Video Conversations



The Perfect Restaurant for a Birthday Party

Imagine you are helping to organize a birthday party for your best friend. You need to choose a restaurant for the celebration. Think about a restaurant you like to recommend. Consider the type of food, ambiance, prices, location, and service.



Photo by [tommao wang](#) on [Unsplash](#)

Instructions

- First recording: Create a new thread and answer the following questions:
 - What is the name of the restaurant and where is located?
 - What type of food do they serve?

To count towards completion credit:
Audio/Video comments need to be at least 30 seconds.

- ✗ Initiate 1 discussion thread with new comment(s). ?
- ✗ Submit 1 reply to comments in existing threads. ?

Date Completed: N/A
Date Graded: N/A
Score: N/A

New Thread

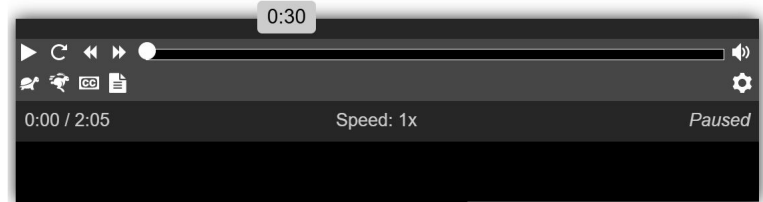
on 3/6/25 at 5:09AM

3/6/25 at 5:09AM
Listen to Comment

TL 3/6/25 at 4:41PM
Listen to Comment

New Comment

Comment by at 3/6/25 at 5:09AM



Auto scroll

Transcript

Good morning, everyone. I think that I would like to recommend a restaurant called Holbox, which is in the city of Los Angeles and is located in El Mercado La Paloma, which is very close to the University of Southern California. What type of food do they serve? The Holbox sirve mostly Seafood, y es una fusión mexicana-california, y ganó una estrella Michelin un par de años atrás y ha sido seleccionado como el mejor restaurante en Los Angeles. ¿Por qué es un buen restaurante para una celebración de cumpleaños? Me llevó a mi

Timing Choose a time range

Releasing soon... Accounting Homework

< 1 ... 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 >

Submission Information

Journal Entry Descriptions:

1: Lutz contributed cash of \$5,700 and computers worth \$4,300 to the business.

#2: Sold equipment worth \$11,000 and book value of \$1,000 for \$2,000 in cash

Complete the Journal Entries:

Entry	Account Title	Debit	Credit
Select an entry... ▾	Start typing account title...		
	Start typing account title...		
Select an entry... ▾	Start typing account title...		
	Start typing account title...		

Submit

Attribution

Reset Submission

Contact Grader

Journal Entries

Releasing soon... Accounting Homework



Preparing an Income Statement

Prepare an income statement using the following information for DL Enterprises for the month of August 2026.

Sales Revenue	\$62,500
Rental Revenue	15,300
Product Expense	52,200
Wages Expense	18,900
Owner Investment	12,000
Equipment Purchases	56,000
Utilities Expense	1,800
Taxes Expense	400

DL Enterprises
Income Statement
For the Month Ended August 31, 2026

Revenues

Select...		
Select...		
Select...		

Expenses

Select...		
Select...		
Select...		
Select...		
Select...		
Select...		

[Submit](#)

Releasing soon... Accounting Homework



Prepare an income statement using the following information for DL Enterprises for the month of August 2026.

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Utilities Expense	1,800
Taxes Expense	400

DL Enterprises

Income Statement

For the Month Ended August 31, 2026

Revenues

Releasing soon... Accounting Homework



DL Enterprises
Income Statement
For the Month Ended August 31, 2026

Revenues

Select... ▾	<input type="text"/>	
Select... ▾	<input type="text"/>	
Select... ▾		<input type="text"/>

Expenses

Select... ▾	<input type="text"/>	
Select... ▾	<input type="text"/>	
Select... ▾	<input type="text"/>	
Select... ▾	<input type="text"/>	
Select... ▾		<input type="text"/>
Select... ▾		<input type="text"/>

Submit

Releasing soon... Accounting Homework

Question #68

Status: Open ?

-/10 points

∞ attempts left

< 1 ... 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 **68** >

Submission Information

For each independent situation below, calculate the missing values.

Assets	Liabilities	Equity
32000	17000	<input type="text"/>
168700	<input type="text"/>	146300
17500	16830	<input type="text"/>
<input type="text"/>	232000	330700
382170	<input type="text"/>	125270

Submit

Attribution

Reset Submission

Contact Grader

Balance Sheet

[Add Questions](#) [New Question](#) **Questions**

Assignment Information

Questions

Case Study Notes

Properties

Open Grader

This assignment has H5P assessments in a course which allows anonymous users. Because of the nature of H5P, any user will be able to view both the questions and solutions when logged in as Anonymous.

This assignment has H5P assessments in an assignment that provides real time feedback and allows multiple attempts. Due to the nature of H5P, students will see the correct responses after their first attempt.

It looks like the following assessments have an open-ended component: 7. These types of assessments are appropriate for delayed assessments. Please either change the assessment type to Delayed or remove these assessments.

This is a formative assignment. Students will have access to their submissions during a single session.

Order	Title ↓↑	ADAPT ID ⓘ ⓘ	Submission	Solution	Actions
≡ 1	Welcome and Introduction Discussion ⓘ ⓘ ⓘ	125249-284501 ⓘ	discuss it	N/A	✎ ⓘ ⓘ

Whitelisted Domains

For courses not served through an LMS, whitelisted domains determine acceptable emails for students in your course. For example, if you just want to accept mySchool.edu email addresses, you can whitelist mySchool.edu.

Then, only students using email addresses that contain mySchool.edu will be able to enroll.

Whitelisted Domains* ⓘ [Add whitelisted domain](#)

libretexts.org x

Assignment Grader Notifications

With Grader Notifications, you can optionally let your graders know when assignments are closed and when students submit late submissions. These emails will be sent out once per day.

Notify graders when assignments are closed

Notify graders when students submit after the assignment is closed

Additionally, you can also send your graders reminders to finish grading ungraded assessments with one email sent per time period.

Frequency of reminders

- ✓ Never
- Once a week
- Twice a week
- Three times a week
- Every day

[Update](#)

Embed information

If you embed ADAPT in another webpage, such as a Libretex, you can control how much information is shown to the student. Assignment, Submission, and Attribution information can be updated at the question level within an assignment, or you can perform a mass update here. You can also choose to show or hide the question numbers.

By default, the question numbers, attribution (author/license), assignment information (assignment name), and submission information (date of submission) are not shown.

Question numbers: Hidden

Assignment Information: [Show All](#) [Hide All](#)

Submission Information: [Show All](#) [Hide All](#)

Attribution: [Show All](#) [Hide All](#)

A11y Redirect

ADAPT integrates a variety of open-source technologies, some of which have accessibility issues which are beyond our control. To remedy this, ADAPT can serve your students modified questions which satisfy web-based accessibility requirements assuming that an accessible version of the question has been created.

The fields marked with an asterisk are required.

Student*

Please choose a student

Redirect to*

- a11y technology
 text question

Save A11y Redirect

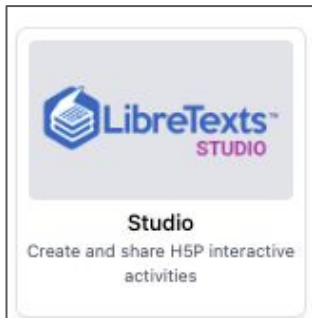
No students will receive a11y versions of your questions.

You can optionally provide a secondary accessible auto-graded question which can be shown on a per-student basis. Please provide an ADAPT ID of the form {assignment ID}-{question ID} or {question ID}

Auto-Graded Alternative ? ▼

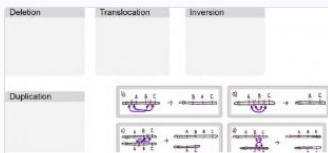
View

Studio: H5P Interactives Authoring & Database



Featured H5P

[Browse All H5P](#) >



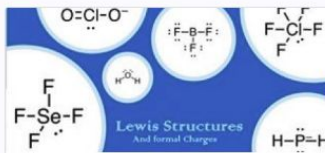
Match the chromosomal rearrangement with the correct type.

[Drag and Drop](#)

Ahad Nadeem @ University of Arkansas at Little Rock (UALR)

CC BY

Biology



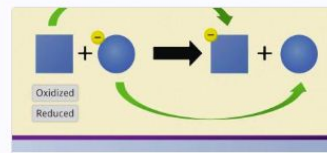
PASS Lewis Structure guided interactive video (Q4.E.60)

[Interactive Video](#)

Sharon Brewer @ Thompson Rivers University

CC BY-NC-SA

Chemistry



Redox Practice

[Course Presentation](#)

Jeanne Kagle @ Mansfield University

CC BY

Biology



Return to Calculus Island: The Serum

[Branching Scenario](#)

Bamdad Samii @ Los Angeles Mission College

CC BY

Mathematics



Mineral Luster

[Column](#)

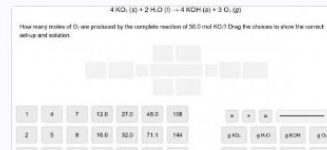
Allison Jones @ Sierra College



Regulations on Fintech

[Interactive Video](#)

Sophie K @ Western Washington



4 KO₂ (s) + 2 H₂O (l) → 4 KOH (s) + 3 O₂ (g)

How many moles of O₂ are produced by the complete reaction of 365.0 mol KO₂? Drag the checkboxes to show the correct set-up and solution.

1	4	7	12.0	27.0	48.0	108				
2	5	8	18.0	32.0	71.1	144	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Stoichiometry: Find Moles of O₂ Generated By KO₂ in Rebreathing Mask

[Drag and Drop](#)



De Broglie Waves and the Uncertainty Principle

[Interactive Book](#)

Accessibility: Ask more questions and get answers on Accessibility

H5P Accessibility Concerns:



Is H5P Accessible?

Studio Accessibility H5P Delmar replied 2 days ago

Connections
Connect and converse with fellow instructors and OER authors.

On the Launchpad for Verified Instructor Accts or at: connections.libretexts.org

The screenshot shows the Connections forum interface. At the top, there's a navigation bar with 'CONNECTIONS Spring 2024', 'LibreTexts', 'Academy', and 'Faculty Resources'. A search bar and user profile for Justin Shorb are also visible. The main heading is 'Accessibility' with the subtitle 'Questions about making your material accessible.' Below this, there's a 'Start a Discussion' button and a 'Latest' dropdown menu. A list of discussion topics is displayed, including 'What is Accessibility and Where do I find LibreTexts Documentation on it?', 'What defines "archived" content under the DOJ rule?', 'Is H5P Accessible?', 'Who is legally liable for accessibility errors of content on LibreTexts?', 'How accessible is LibreTexts?', 'How accessible is the ADAPT homework system for students using screen readers?', 'What is the hard deadline for updating my content to be accessible?', and 'Does the Conductor project management tool help with accessibility auditing?'. Each topic includes a question mark icon, the user who started the discussion, the time since it was posted, and the number of replies.

Embed information

If you embed ADAPT in another webpage, such as a Libretxt, you can control how much information is shown to the student. Assignment, Submission, and Attribution information can be updated at the question level within an assignment, or you can perform a mass update here. You can also choose to show or hide the question numbers.

By default, the question numbers, attribution (author/license), assignment information (assignment name), and submission information (date of submission) are not shown.

Question numbers: Hidden

Assignment Information: [Show All](#) [Hide All](#)

Submission Information: [Show All](#) [Hide All](#)

Attribution: [Show All](#) [Hide All](#)

Atomic Structure and Nuclear Reactions

- Describe atomic structures using the sub-atomic particles most relevant to chemists (protons, neutrons, and electrons), including charges, normal relative locations, and approximate masses of all species.
- Define the word isotope and provide examples of important radioactive isotopes in environmental chemistry, carbon-14 dating, and other applications.
- Calculate relative abundances of isotopes, exact isotopic masses, and/or average atomic mass from provided data.
- Write balanced chemical reaction equations for nuclear reactions.
- Define and provide symbols for some species that can be emitted in nuclear reactions: positron, neutron, alpha particle, beta particle, gamma ray.
- Define and be able to calculate binding energy and mass decrement or mass defect.
- Define fission and fusion and describe similarities and differences between these processes.
- Perform quantitative calculations for the half-life involved in radioactive decay.

Be sure you are logged in to your ADAPT Homework system so that you can see the assignment.



Login with LibreOne to view this question

NOTE: If you typically access ADAPT assignments through an LMS like Canvas, you should open this page there.

[Login](#)

How much does it cost?

- Institutional Costs:
- Instructor Costs:
 - Access to the Question Bank Cost:
 - Course Building Cost:
 - Question Authoring Cost:
- Student Costs:
 - Per Course Cost:
 - Per Semester/Term Cost:
 - Annual Cost:

- What costs LibreTexts the most?

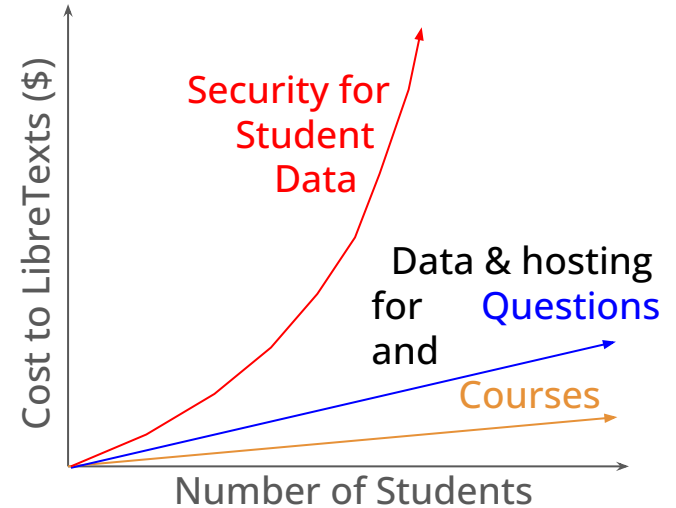
How much does it cost?

- Institutional Costs: **\$0**
- Instructor Costs: **\$0**
 - Access to the Question Bank Cost: **\$0**
 - Course Building Cost: **\$0**
 - Question Authoring Cost: **\$0**
- Student Costs:
 - Per Course Cost: **\$0**
 - Per Semester/Term Cost: **\$15**
 - Annual Cost: **\$30 MAX**

- What costs LibreTexts the most?

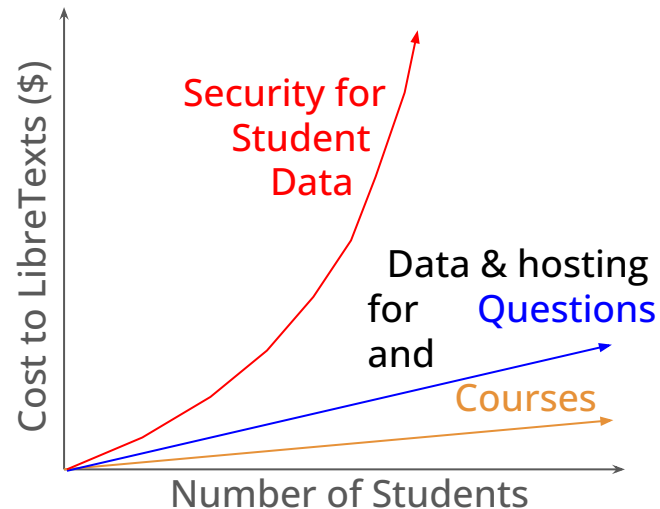
How much does it cost?

- Institutional Costs: **\$0**
- Instructor Costs: **\$0**
 - Access to the Question Bank Cost: **\$0**
 - Course Building Cost: **\$0**
 - Question Authoring Cost: **\$0**
- Student Costs:
 - Per Course Cost: **\$0**
 - Per Semester/Term Cost: **\$15**
 - Annual Cost: **\$30 MAX**
- What costs LibreTexts the most?
 - Student Data (with Security Protocols)
 - Technology Development



How much does it cost?

- Institutional Costs: **\$0**
- Instructor Costs: **\$0**
 - Access to the Question Bank Cost: **\$0**
 - Course Building Cost: **\$0**
 - Question Authoring Cost: **\$0**
- Student Costs:
 - Per Course Cost: **\$0**
 - Per Semester/Term Cost: **\$15**
 - Annual Cost: **\$30 MAX**
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Numbers which make the boxplot might be returned with `fivenum()` command. Boxplot representation was created by a famous American mathematician John W. Tukey as a quick, powerful and consistent way of reflecting main distribution-independent characteristics of the sample. In R, `boxplot()` is *vectorized* so we can draw several boxplots at once (Figure 4.2.3):

Code 4.2.2 (R): Boxplots

```
boxplot(scale(trees))
```

run restart restart & run all

(Parameters of trees were measured in different units, therefore we `scale()`'d them.)

Histogram is another graphical representation of the sample where range is divided into intervals (bins), and consecutive bars are drawn with their height proportional to the count of values in each bin (Figure 4.2.4):

Code 4.2.3 (R): Histograms

```
hist(salary2, breaks=20)
```

run restart restart & run all

(By default, the command `hist()` would have divided the range into 10 bins, but here we needed 20 and therefore set them manually. Histogram is sometimes a rather cryptic way to display the data. Commands `Histp()` and `Histr()` from the `asmisc.r` will plot histograms together with percentages on the top of each bar, or overlaid with normal curve (or density—see below), respectively. Please try them yourself.)

A numerical analog of a histogram is the function `cut()`:

Code 4.2.4 (R):

```
table(cut(salary2, 20))
```

run restart restart & run all

There are other graphical functions, conceptually similar to histograms. The first is *stem-and-leaf* plot. `stem()` is a kind of *pseudograph*, text histogram. Let us see how it treats the original vector `salary`:

Code 4.2.5 (R): stem-and-leaf plot

```
stem(salary, scale=2)
```

run restart restart & run all

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Histogram is another graphical representation of the sample where range is divided into intervals (bins), and consecutive bars are drawn with their height proportional to the count of values in each bin (Figure 4.2.4):

Code 4.2.3 (R): Histograms

```
hist(salary2, breaks=20)
```

run

restart

restart & run all

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Histogram is another graphical representation of the sample where range is divided into intervals (bins), and consecutive bars are drawn with their height proportional to the count of values in each bin (Figure 4.2.4):

Code 4.2.3 (R): Histograms

```
hist(salary2, breaks=20)
```

run

restart

restart & run all

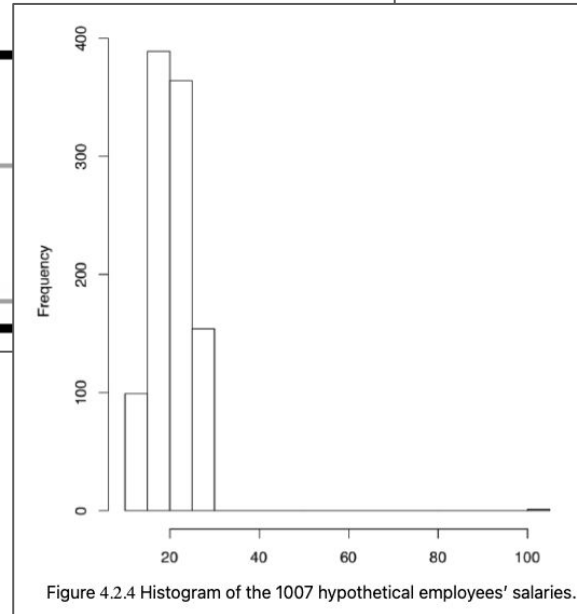


Figure 4.2.4 Histogram of the 1007 hypothetical employees' salaries.



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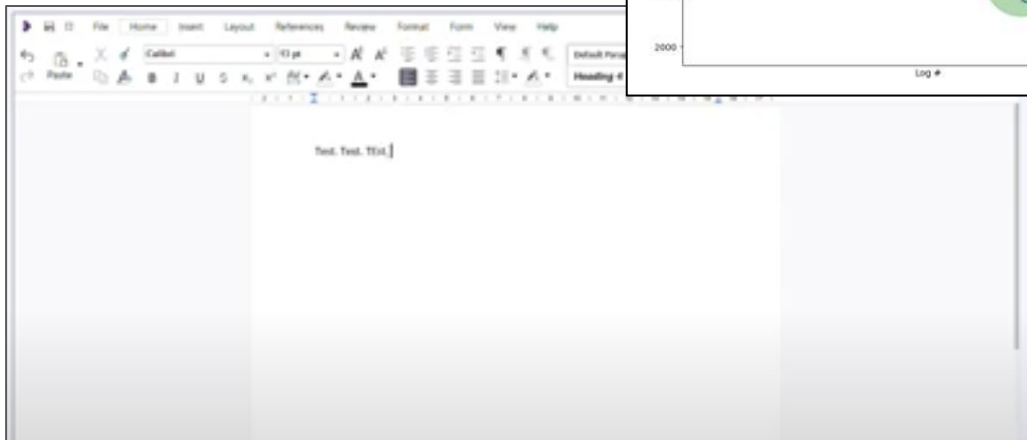
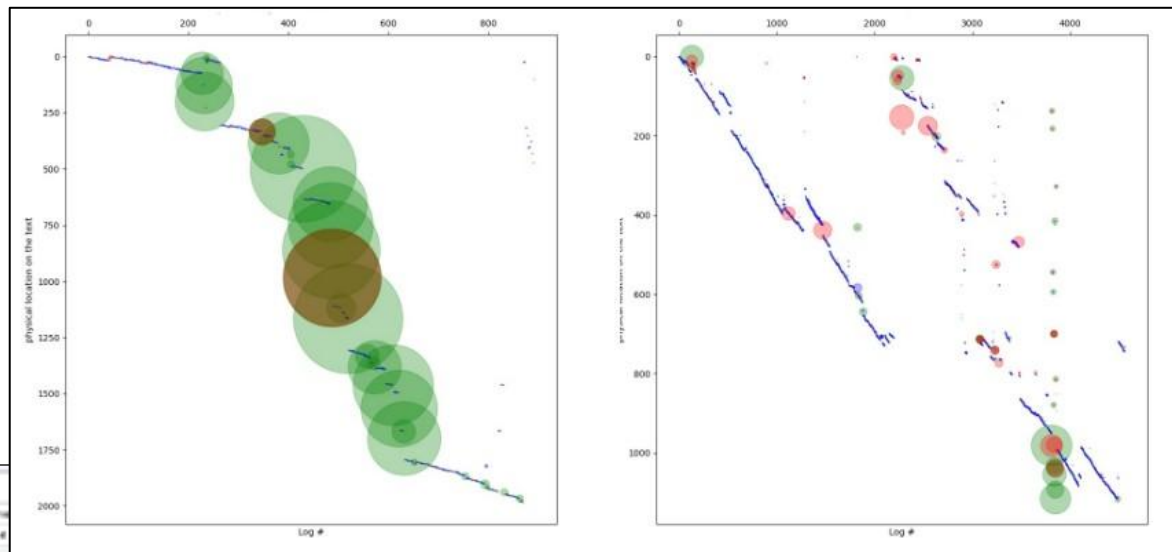
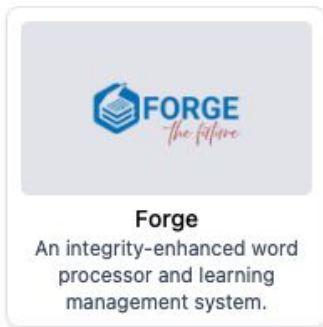


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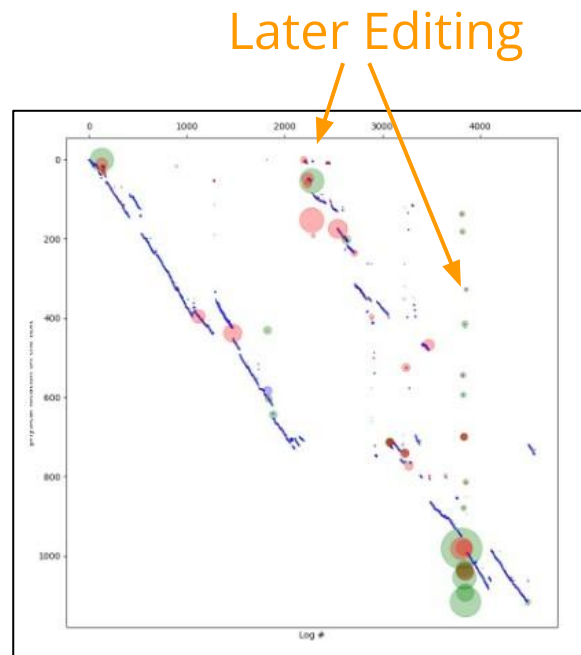
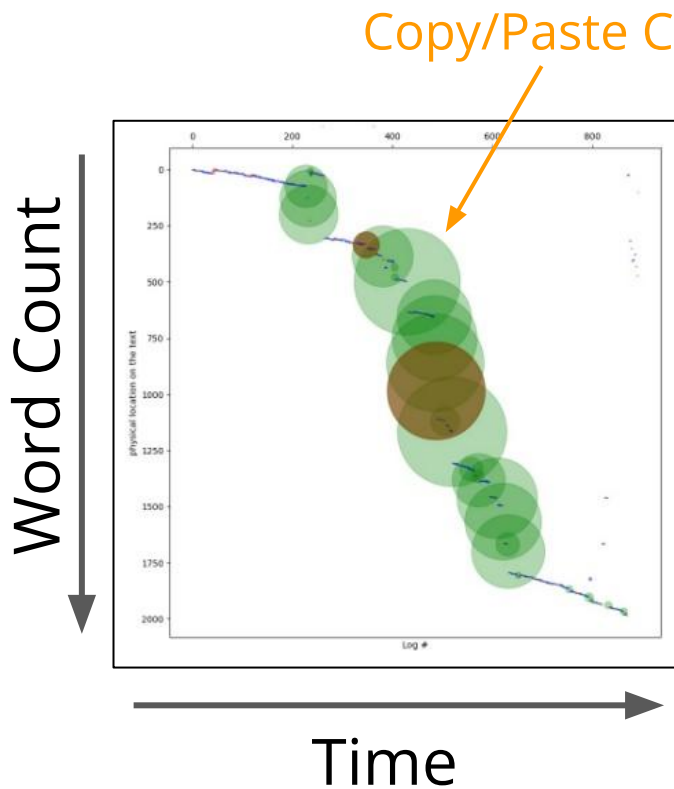


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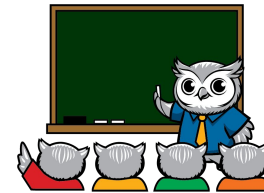
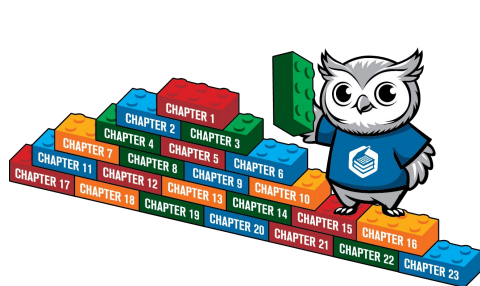
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Thank you!

Any Questions?

