

Building a Strong Foundation: Developing a Curriculum Framework for #TeamGraduate

(OpenAI, 2023)

Project Deliverables

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(Ongagabrian, 2018)

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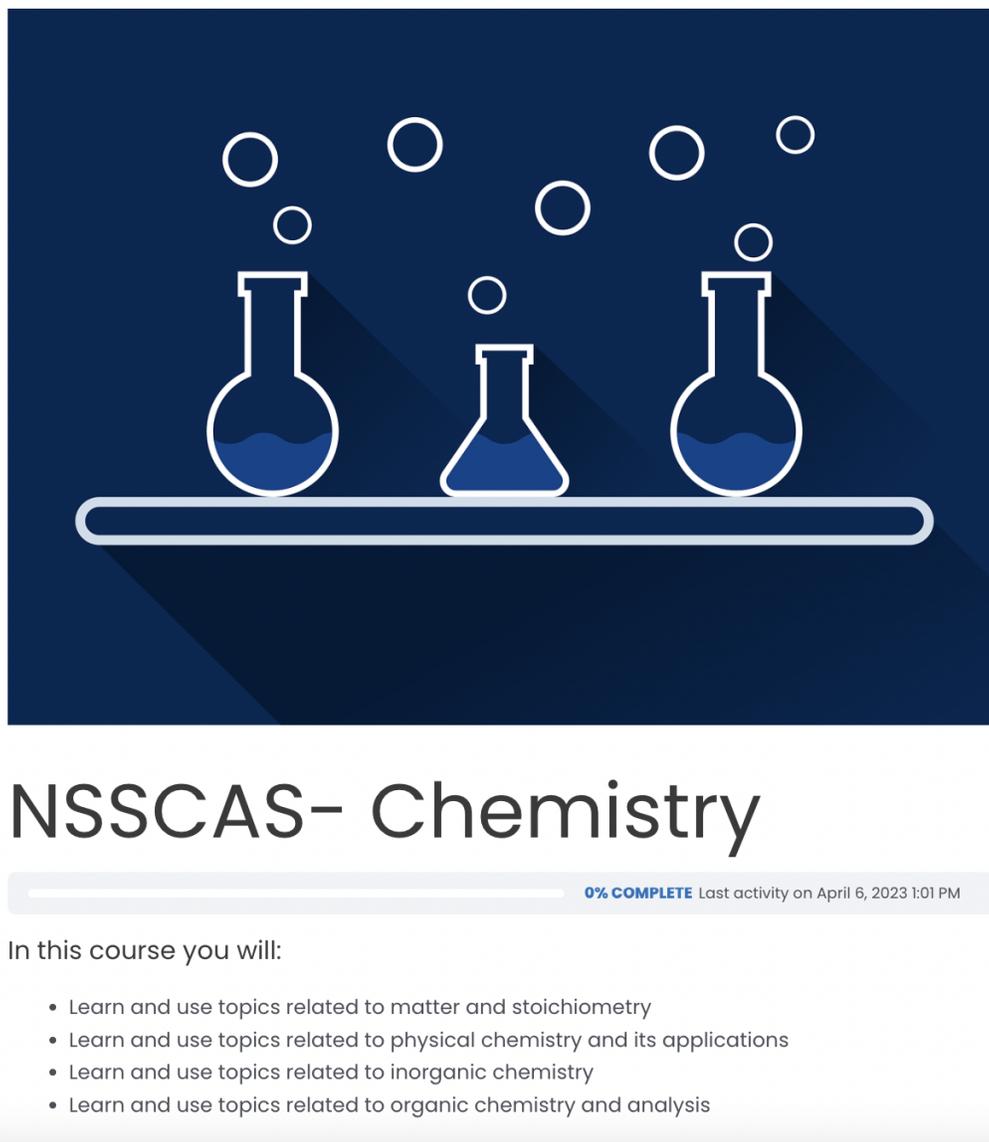
Overview

The goal of our project, in collaboration with #TeamGraduate, was to create three curriculum frameworks that would provide the building blocks for content developers to populate these courses with content for student use, but also to serve as a frame of reference for future course on the #TeamGraduate website. The following images below provide an overview of the three curriculum frameworks that were developed on the #TeamGraduate learning management system. For more information on the process behind creating these frameworks and the deliverables, please refer to our IQP report. All of the images have been taken from the student's view, rather than the creator's view.

Section 1: NSSCAS Chemistry Framework

Figure 1.1:

Main landing page of the chemistry framework



Shown in Figure 1.1 is the main landing page for the course. As described by the syllabus, the main learning objectives for the course have been included. These learning objectives correspond to the four modules in the course. An example module is shown later in Figure 1.3.

Figure 1.2:

Notes for content creators regarding some of the components of this course as well as the introductory module for students

Notes for content creators:

About the quizzes: These should be short, 5-10 questions, mainly multiple choice, fill in the blank etc. Used as formative assessments for students and students should pass these before moving on to the next lesson.

About the Final Module exams: These should be longer than the quizzes, but not longer than about an hour. These exams should mimic the kinds of questions that students will encounter on the national exams.

About the case studies: The students should have some guidance (see the learning objectives) but they should conduct most of the research on their own. The purpose of these case studies is to apply what they've learned to a real world example as well as to practice their research skills. Students should have to submit a document describing their findings.

Please see the chemistry content creators guide for more information.

Course Content

Expand All

Introductory Module

Tools and Strategies for Online Learning

Course Guide for Students

To ensure the sustainability of this project, it was vital to include guidance for the content developers who would be working on these frameworks in the future. Both the notes shown above, in Figure 1.2, and a content creators guide video walkthrough have been provided. Additionally, an introductory module for students has also been included in the frameworks, shown above in Figure 1.2. This module includes two lessons. The first contains a free online learning course through edX.com that provides a general overview of tools and information that will help students learn successfully online. The second lesson contains a course guide for students. This course guide is specific to the chemistry course and explains what students will encounter throughout the course as well as what will be expected of them in terms of assignments. This introductory module is intended to help any students, regardless of their experience with online learning, to have a positive experience through #TeamGraduate.

Figure 1.3:

Example module

Module 2: Physical Chemistry

<input type="radio"/> Acids and Bases 6 Topics 1 Quiz	 Expand
<input type="radio"/> Electrochemistry 8 Topics 1 Quiz	 Expand
<input type="radio"/> Chemical Energetics and Thermodynamics 9 Topics 1 Quiz	 Expand
<input type="radio"/> Equilibrium 10 Topics 1 Quiz	 Expand
<input type="radio"/> Kinetics 6 Topics 1 Quiz	 Expand
<input type="radio"/> Catalysis 6 Topics 1 Quiz	 Expand

As described above, the course has four modules and each reflects the main themes presented in the NSSCAS chemistry syllabus. An example module is shown in Figure 1.3.

Figure 1.4:

Example lesson and lesson content, including subtopics and lesson quiz

The screenshot displays a lesson interface for the topic of Kinetics. At the top left, there is a circular icon and the text 'Kinetics', with '6 Topics | 1 Quiz' below it. On the top right, there is a 'Collapse' button with an upward-pointing arrow. A dark blue header bar contains a document icon, the text 'Lesson Content', and '0% COMPLETE | 0/6 Steps'. Below the header, a list of topics is shown, each with a circular icon and a horizontal line underneath: 'Reaction energy diagrams', 'Rates of reactions', 'Collision frequency', 'Effect of concentration on reaction rate', 'Activation energy and the Boltzmann distribution', and 'Effect of temperature on reaction rate'. At the bottom of the list is a 'Kinetics Quiz' item with a document icon and a downward-pointing arrow.

Within the modules are the lessons, and an example lesson is shown in Figure 1.4. Under each lesson are its corresponding topics. Each lesson contains approximately ten topics and one quiz at the end. The quizzes are meant to serve as formative assessments to allow students to check their understanding as they move through the course. Quizzes are intended to be short assignments, mostly containing multiple-choice and fill-in-the-blank questions.

Depending on the student's pace, students should expect to finish one to two lessons per week. Some lessons are short and may only contain 5-6 topics, and some are longer, containing 12 topics, so this pace may vary depending on where the student is in the course.

Figure 1.5:

Example of the topic content

Orbitals, electron energy states & quantum numbers

The screenshot shows a navigation breadcrumb: All Courses > NSSCAS- Chemistry > Atomic Structure > Orbitals, electron energy states & quantum nu... In the top right corner, there is a dark blue button labeled 'IN PROGRESS'. Below this, a progress bar is shown with the text 'LESSON PROGRESS' on the left and '0% COMPLETE' on the right.

The following videos provide an overview of orbitals and energy states:

<https://www.labxchange.org/library/items/lb:LabXchange:ffbdca9d:video:1>

<https://www.labxchange.org/library/items/lb:LabXchange:718fb26f:video:1>

Students should be able to describe the concept of s, p and orbitals

Students should be able to sketch the s and p orbitals

Students should understand how orbitals and quantum numbers are related and describe orbitals in terms of the primary quantum numbers (1,2,3, 4s and 4p) as well as how energy levels change between quantum numbers

Students should understand electron energy states as well as be able to complete electron filling diagrams up to sub-shell 4d

Students should be able to state and draw the electronic configuration of atoms and ions given their atomic number and charge

Each topic contains guidance that reflects the learning outcomes as described by the syllabus, as shown in Figure 1.5. The learning outcomes are intended to allow the content developers to focus their content on the material deemed important by the syllabi. However, a general overview of each topic should also be included in the content to make sure that all students have the appropriate background information before diving into the specifics.

In addition to learning outcomes, suggested resources have also been included into many topics, whenever available, an example is shown in Figure 1.5 and Figure 1.6. Many of these suggested resources have been sourced from LabXChange.com, a freely available website that contains resources across topics and subjects.

Figure 1.6:

Example of a case study assignment

Case Study: Haber–Bosch Process

All Courses > NSSCAS– Chemistry > Equilibrium > Case Study: Haber–Bosch Process

IN PROGRESS

LESSON PROGRESS

0% COMPLETE

Introductory video: <https://www.labxchange.org/library/items/lb:LabXchange:0e335f14:video:1>

Students should research and understand the following topics:

Why the Haber–Bosch process was developed and who developed it

The basic reaction mechanism and reaction set up (conditions, apparatus etc) – students should be able to explain why these choices were made as it relates to equilibrium and kinetics and why it matters

Students should be able to describe the reactants and the products as well as the basic energetics of the reaction

Students should be able to explain the use of a catalyst in this reaction and what would happen without it

Students should be able to connect the principles and ideas behind the Haber–Bosch process to equilibrium and kinetics

To allow students to develop their research skills as well as to apply their knowledge, case studies have been included in the course. These case studies provide students with guidance and learning objectives for the case study but they should conduct the research independently, an example case study is shown above in Figure 1.6. These case studies not only ask students to think critically about the topics they are researching but also to make connections between applicable, practical knowledge and the information presented in this course.

In addition to the case studies, hands-on simulation and lab activities have been built into the topic content. Figure 1.7 shows a screenshot of an interactive lab by LabXChange to supplement the experience they would have received in an in-person chemistry lab. By applying the knowledge that students learn through the course to hands-on activities they are using higher-order skills such as critical thinking and reasoning. This is a critical aspect of the #TeamGraduate platform and will be key to student success.

To allow students to practice taking exams, module exams have been included in the course and can be seen above in Figure 1.8. These exams are meant to be longer and the questions are meant to reflect the rigor and types of questions that students will encounter on their final exams. Students should take these exams after they finish a module.

Figure 1.7:

Example of lab activity demonstrating the pH scale

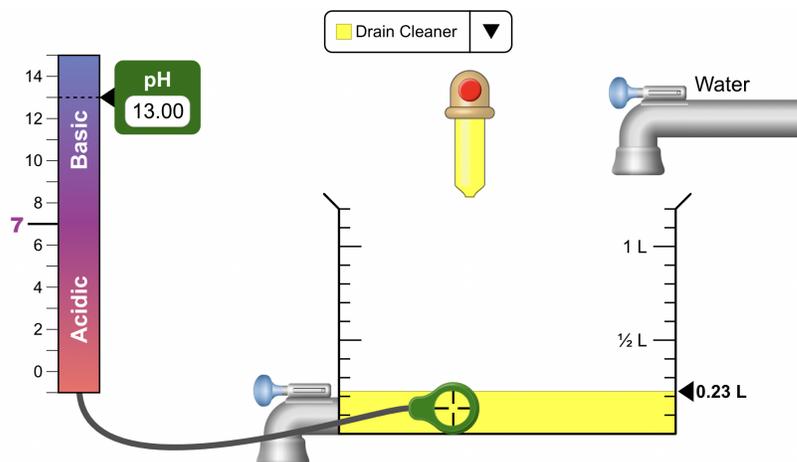


Figure 1.8:

Module exams found at the end of the course

- Module 1 Exam
- Module 2 Exam
- Module 3 Exam
- Module 4 Exam

Section 2: NSSCAS Mathematics Framework

Figure 2.1

Course main page and learning objectives

NSSCAS Mathematics

0% COMPLETE Last activity on April 6, 2023 2:38 PM

This course will cover the course content covered on the NSSCAS level Mathematics examination. It is recommended that learners who begin this course should have previously completed Mathematics at the NSSCO level. It will focus on the following learning objectives:

- Understand relevant mathematical concepts, terminology, and notation
- Interpret, transform, and make appropriate use of mathematical statements expressed in words or symbols
- Analyze a problem, select a suitable strategy, and apply an appropriate technique to obtain its solution
- Apply combinations of relevant mathematical skills and techniques in problem-solving
- Present mathematical work and communicate conclusions in a clear, concise, and logical way

This course is organized into different modules, lessons, and topics. It is recommended to proceed through this course linearly as some topics may require content covered in a previous module. Within some topics, there will be graphing activities that require the internet to access the online resource.

Figure 2.1 displays the course main page and learning objectives taken from the NSSCAS level mathematics syllabus. This is the main page for the course and provides an overview of the course setup, which will be discussed later in this Appendix.

Figure 2.2 shows the introductory module, which includes a guide to online learning that is required for all students to complete before beginning the course. This guide equips students with tools and strategies for learning online. Additionally, the introductory module includes an overview of the course for content creators.

Figure 2.2

Introductory module

Course Content

Expand All

MODULE 0: INTRODUCTION & OVERVIEW

Guide to Online Learning

Guide to this Course (for content creators)

Figure 2.3

Guide for content creators

About the quizzes: There will be quizzes following each lesson to be completed before moving on to the next lesson. These are meant to be a check for understanding. These should be short, 5-10 questions, mainly multiple-choice, fill-in-the-blank, etc. Used as formative assessments for students and students should pass these before moving on to the next lesson.

About the cumulative exam: There is a cumulative exam at the end of the course which will serve as examination prep for the NSCAS level examination. This should be longer than the quizzes, but not longer than about an hour. It should mimic the kinds of questions that students will encounter on the national exams.

Please see the mathematics content creator's video guide for more information.

Recommended pace: 1-2 lessons a week on average (for a student completing this course full-time)

- Module 1 – 4 weeks
- Module 2 – 3 weeks
- Module 3 – 2.5 weeks
- Module 4 – 6 weeks
- Module 5 – 2 weeks

As seen in Figure 2.3, there are instructions about the content that is yet to be added to the course. It provides more details about the quizzes and cumulative exams. Furthermore, this course guide provides a recommended pacing for the course.

The course is broken up into modules, lessons, and topics. Figure 2.4 shows one of the modules and Figure 2.5 shows an example lesson with topic and quiz pages within it. There are quizzes at the end of each lesson, intended as a formative assessment to check the student's understanding. Since the nature of mathematics involves many definitions, there are additional quizzes following certain topics to reinforce learning.

Figure 2.4

Example module

MODULE 1: ALGEBRA

The image shows three expandable module items, each in a rounded rectangular box. Each item consists of a radio button, a title, a subtitle, and an 'Expand' button with a downward arrow icon.

- Algebraic Expressions, Equations, and Inequalities
5 Topics | 1 Quiz
- Quadratic Equations
7 Topics | 1 Quiz
- Sequences and Series
4 Topics | 1 Quiz

Figure 2.5

Example lesson with topics and quizzes

The image shows a lesson content interface for 'Trigonometric Functions'. At the top, there is a radio button, the title 'Trigonometric Functions', a subtitle '5 Topics | 2 Quizzes', and a 'Collapse' button with an upward arrow icon. Below this is a dark blue header bar with a document icon, the text 'Lesson Content', '0% COMPLETE', and '0/5 Steps'. The main content area lists seven items, each with a radio button or a checked checkbox icon, followed by a horizontal line:

- Graphs of trigonometric functions
- GeoGebra Activity: Graphing trigonometric functions
- Trigonometric ratios
- Trig ratios quiz
- Inverse trigonometric functions
- Periodicity
- Trigonometric function quiz

Figure 2.6

Example topic page

Gradient of a curve

The screenshot shows a topic page for 'Gradient of a curve'. At the top, there is a breadcrumb trail: 'All Courses > NSSCAS Mathematics > Differentiation > Gradient of a curve'. To the right of this trail is a dark blue button with the text 'IN PROGRESS'. Below the breadcrumb trail is a progress bar. On the left side of the progress bar, it says 'LESSON PROGRESS' and on the right side, it says '0% COMPLETE'. Below the progress bar, there is a paragraph of text: 'Topic focus: interpret the idea of the gradient of a curve and use the notations $f'(x)$, $f''(x)$, $\frac{dy}{dx}$, and $\frac{d^2y}{dx^2}$.' Below this paragraph is a note: 'Note: the technique of differentiation from first principles is not required'. Below the note is another paragraph: 'For a more involved understanding of the derivative and essence of calculus, [this playlist of YouTube videos](#) is very helpful!'. At the bottom of the page, there are three dark blue buttons: 'Previous Lesson' with a left arrow, 'Mark Complete' with a checkmark, and 'Next Topic' with a right arrow. Below the 'Mark Complete' button is the text 'Back to Lesson'.

Figure 2.6 shows an example of a topic page. Within each topic page, there is a topic focus that aligns with the learning objectives in the NSSCAS level mathematics syllabus. Notice that the math symbols are written in math mode of LaTeX syntax. LaTeX encoding has yet to be added to the learning management system, but the content creators' familiarity with LaTeX syntax will determine the feasibility of using LaTeX for the final version of this course. Additionally, for some topics, supplementary YouTube videos are included, as seen in Figure 2.6, to provide further explanations and visualizations of the learning objectives.

Figure 2.7

Example graphing activity

GeoGebra Activity: Graphing trigonometric functions

All Courses > NSSCAS Mathematics > Trigonometric Functions > GeoGebra Activity: Graphing trigono...

IN PROGRESS

LESSON PROGRESS

0% COMPLETE

Activity focus: understand the graphs of trigonometric functions (for angles of any size, in radians or degrees) and identify the amplitude and period of a given equation. Additionally, be able to sketch and interpret graphs of the form $y=a\sin(bx)+c$, $y=a\cos(bx)+c$, and $y=a\tan(bx)+c$.

Use [this link to GeoGebra](#) to play around with the parameters to see how the amplitude and period of a function affect the graph.

Specific to the mathematics framework, we have included graphing activities throughout the modules. These hands-on activities allow students to visualize the content they are learning in the lessons and topic and serve as another means of content delivery especially for visual learners. Figure 2.7 displays one such graphing activity about the transformations a trigonometric function undergoes when changing the amplitude and period of the function. Like the topic pages, these graphing activities have an activity focus and hyperlinks to the online graphing calculators. Some of these graphing activities are guided while others are more free-form to allow students to explore and research on their own.

Figure 2.8

Examination prep and cumulative exam

EXAMINATION PREPARATION

Overview

2006 NSSCH Level (Old syllabi)

Cumulative exam

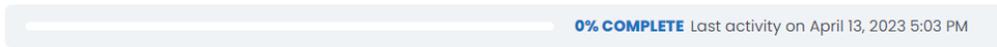
Finally, there is an examination preparation module, as seen in Figure 2.8, at the end of the course to prepare students for the NSSCAS level mathematics examination. The overview provides students with best practices for taking these past exam papers as practice exams. Additionally, it includes the scheme of assessment to inform students of the exam format. Following the completion of the course, there is a cumulative examination to assess the student's mastery of the course content. The questions are intended to mirror those on the NSSCAS level mathematics examination as additional practice for the examination.

Section 3: NSSCAS English Second Language Framework

Figure 3.1

Course main page and learning objectives

NSSCAS English Second Language



This course will cover the course content outlined in the NSSCAS level English Second Language examination. It is recommended that learners who begin this course previously completed the NSSCO level English Second Language examination. This course focuses on the following objectives:

- Develop the ability to understand and use a second language in a variety of registers
- Communicate confidently and clearly in a second language
- Form a sound base of social and other skills, language and attitudes required for further study, work and leisure
- Develop positive attitudes to language learning and an empathetic approach to other cultures and different points of view
- Develop a wider awareness and knowledge of contemporary issues through extensive reading
- Develop skills in writing structured and convincing arguments, present a point of view clearly and with reasoned explanations.

This course will cover the content outlined in the NSSCAS level syllabus and is organized into

The main English Second Language course page, shown in Figure 3.1, lists the objectives found in the NSSCAS syllabus. It provides the students with their learning goals and an overview of how to navigate the course.

Figure 3.2

Introductory module

Module 0: Introduction & Overview

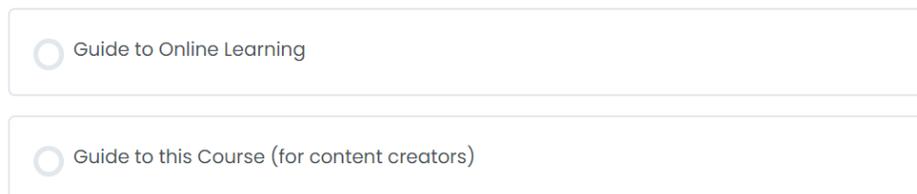


Figure 3.2 shows the first module, Module 0. Module 0 contains a guide to online learning for students taking the course and a guide for adding content for the content creators.

Figure 3.3

Course guide for content creators

About the quizzes: There will be quizzes following each lesson to be completed before moving on to the next lesson. These are meant to be a check for understanding. These should be short, mainly multiple-choice, fill-in-the-blank, etc. There are recommendations for how long the quizzes should be on the quiz pages. They are used as formative assessments for students and students should pass these before moving on to the next lesson.

About the module exams: The module exams contain recommendations for content on their quiz page. The first module exam reflects paper 1 of the NSSCAS English Second Language exam. The other two module exams should assess the student's understanding of the module content.

Please see the English Second Language content creator's video guide for more information.

Recommended pace: 1-2 lessons a week on average (for a student completing this course full-time)

- Module 1: 2 weeks
- Module 2: 1 week
- Module 3: 1 week
- Final Exam: 1 week

Please note that there are currently no reading assignments. The content creators need to determine how many reading assignments should be added and what texts are read. There also needs to be quizzes on the readings to ensure the student is doing them. Keep in mind these readings might change the length of time a student will spend on a module.

The content creators are also provided a walkthrough video of how to add this content. In Figure 3.3, the Guide to this Course (for content creators) page is shown. It explains what the quizzes and exams should look like, as well as the recommended pace for the learners. At the bottom, there is a note about reading assignments. Since there are no recommendations for literature and how many pieces should be read, we left the reading assignments for the content creators because we do not have the experience to do so.

Figure 3.4

Example module

Module 1: Reading and Directed Writing

The screenshot displays a list of four lessons under the heading 'Module 1: Reading and Directed Writing'. Each lesson is contained within a light gray rounded rectangle. On the left of each lesson is a radio button icon. To the right of the lesson title are counts for topics and quizzes. On the far right of each lesson box is a dark blue 'Expand' button with a downward-pointing chevron icon.

Lesson Title	Topics	Quizzes	Action
Conventions of Writing	3 Topics	1 Quiz	Expand
The Linguistics Elements and Literary Features of Texts		2 Quizzes	Expand
Significance of Audience	2 Topics	1 Quiz	Expand
Contributions to the Meaning of Texts	3 Topics	1 Quiz	Expand

There are three modules within the English Second Language course. Module 1 is the longest out of the three and the first half of it can be seen in Figure 3.4. The modules are split up into lessons and some are split further into topics as seen in Figure 3.5. There are quizzes after each lesson and occasionally after topics if necessary. Also, there are exams at the end of each module inside the last lesson as seen in Figure 3.5. The quizzes and exams should assess the understanding of the student from what they learned in the lessons and modules respectively. Notice how there are two quizzes within The Linguistics Elements and Literary Features of Texts lesson in Figure 3.4. One of these quizzes is actually an assignment, the Parts of Speech Assignment, seen in Figure 3.6. This assignment was created to incorporate a different style of text to engage the learners which was recommended by an interviewee.

Figure 3.5

Example lesson with topics, formative quizzes, and module examinations

The screenshot shows a lesson interface for 'Figurative Language'. At the top, there is a header with a radio button icon, the text 'Figurative Language', and a 'Collapse' button with an upward arrow. Below the header, it says '5 Topics | 2 Quizzes'. A dark blue navigation bar contains a document icon, the text 'Lesson Content', and '0% COMPLETE | 0/5 Steps'. The main content area lists several items, each with a radio button icon: 'Imagery', 'Simile', 'Metaphor', 'Idiomatic Expressions', and 'Proverbs'. Below these are two items with a document icon: 'Figurative Language Quiz' and 'Module 3 Exam'.

Figure 3.6

Example assignment

Parts of Speech Assignment

By Caitlin Ho / April 24, 2023

[All Courses](#) > [NSSCAS English Second Language](#) > [The Linguistics Elements and Literary Features of Texts](#) > [Parts of Spe...](#)

The student will copy and paste the chorus from their favorite song and pick out the parts of speech. To do so, they will make a list of nouns, pronouns, adjectives, verbs, adverbs, prepositions, conjunctions, and interjections.

Figure 3.7

Example module examination

Module 1 Reading & Writing Exam

By Caitlin Ho / April 12, 2023

All Courses > NSSCAS English Second Language > Writing Concise Responses to Text > Module 1 Reading & Writing Exam

Reflects paper 1 of NSSCAS:

Learners read a text of approximately 700 words and answer 5 multiple choice questions.

Questions focus on testing high level reading skills, such as:

- detail
- implication
- tone
- purpose
- opinion/attitude
- text organizational features

Then learners read a text of approximately 700 words and answer a number of open-ended comprehension questions that focus on testing high level reading skills such as:

- identify and explain vocabulary and structures
- understand implicit and explicit meanings
- ability to understand main ideas/gist
- interpret complex language
- synthesize information
- identify implied meaning
- draw inferences

The first module exam reflects paper 1 of the NSSCAS English Second Language exam. The structure and expectations of paper 1 can be seen in Figure 3.7 and an example is in Figure 3.8.

Figure 3.8

Example NSSCAS English Second Language Paper 1

See Paper 1 of the following document for an example:

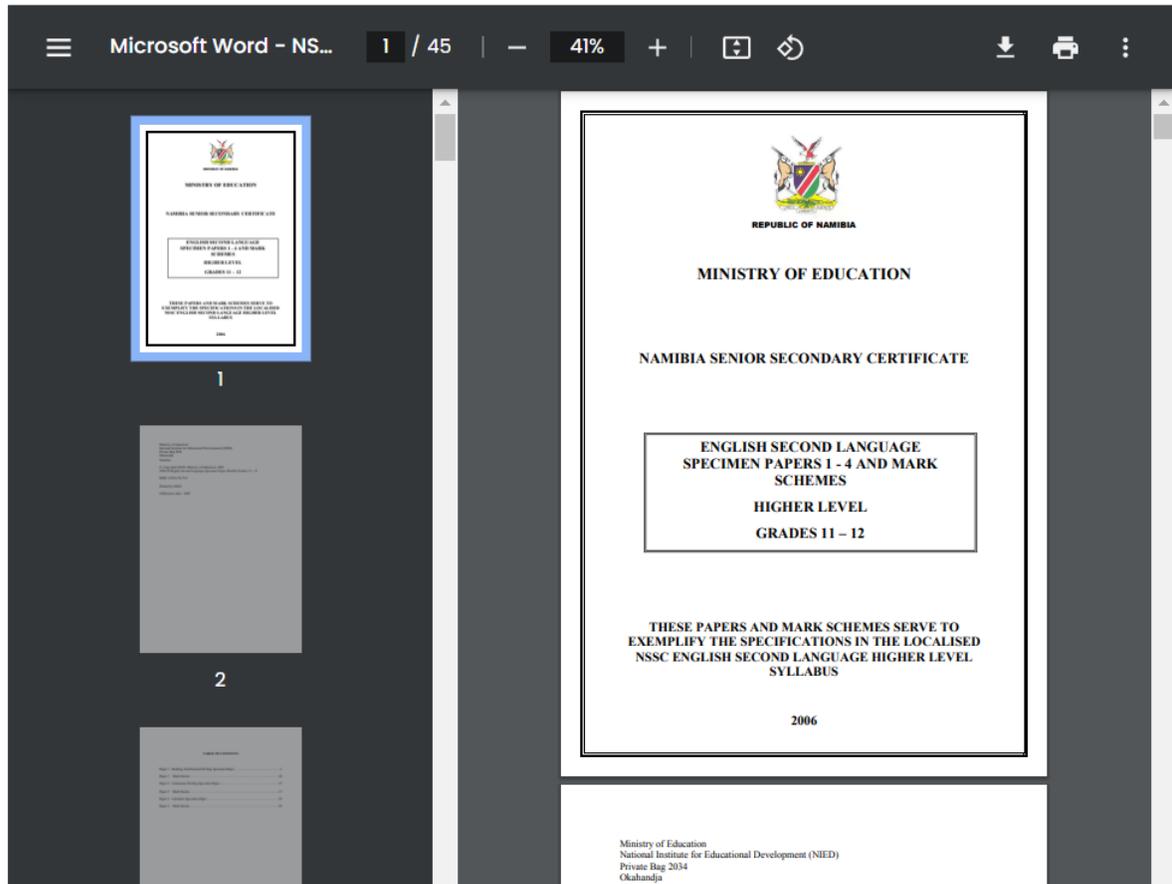


Figure 3.9

Final writing assignment and example NSSCAS English Second Language Paper 2

Final Writing Assignment

By Caitlin Ho / April 13, 2023

All Courses > NSSCAS English Second Language > Final Writing Assignment

This assignment should reflect the Essay Writing portion of the NSSCAS exam (Paper 2). The student will perform research on each topic and choose two questions to respond to in an essay format. Refer to the attached NSSCAS Syllabus file in section 6.4 for more information.

6.4 Topics for the Essay Paper

Learners who follow the NSSCAS English Second Language Syllabus will have the opportunity to gain knowledge and understanding of issues in these topic areas in their preparation for the Essay Paper. Learners consider topics within local and international contexts.

Questions will be based on the five topics specified for the year of examination. Year 1 will begin in 2021. Year 5 will end in 2025. Year 1 will begin again in 2026. Though the five topics per year given below are *prescribed*, their example *sub-topics* on the next page *are not prescriptive*. Sub-topics given under each topic on the next page are just examples and teachers can use any suitable sub-topic to teach.

Years 1 & 6 2021 & 2026	Years 2 & 7 2022 & 2027	Year 3 2023	Year 4 2024	Year 5 2025
Human relationships	Careers	Advertising and marketing	Science	Language and Communication
Climate	The media	Food and drink	Globalisation	Travel and transport
Education	Environment	Free time activities	Sport	Social trends
Tourism	History	Culture	Patterns of daily life	Citizenship
Innovations	Health	Conservation	Nature	The Arts

The last and final assignment is an essay assignment that reflects paper 2 of the NSSCAS English Second Language Exam. In Figure 3.9, on the Final Writing Assignment page, it says the student should research the topics for the year they are taking the exam. Therefore, students will acquire research skills from this course and the content creators do not have to update the course every year.