UNITED ARAB EMIRATES
MINISTRY OF EDUCATION

YEAR OF
ZAYED

CREATIVE DESIGN & INNOVATION

Teacher Guide

Grade 11
Advance

Volume
1 2 3

Creative Design and Innovation

G11 Advance Teacher's Guide

CREATIVE DESIGN
INNOVATION

Term 2 2018-19

Volume 01

Table of Content:

Contents

Introduction:

This Teacher's Guide aims to provide the teachers of Creative Design and Innovation with a set of teacher support materials. This includes the Instructional Planner (IP), the Lesson Plans (LPs) and Answer Keys.

The Instructional Planner aims to provide teachers with the scope and sequence during the term. Teachers will be able to have a detailed idea of when to teach each section of the book and accordingly organise their work during the entire term in advance. The Instructional Planner also highlights the material that will not be assessed throughout the term (self-study), where the details are in the lesson plans in the next section of the Teacher's Guide. The Lesson Plans can be also found on LMS for you reference.

Note that the IP is divided into weeks containing three periods, the same applies to Lesson Plans. These may be organised as double and single or all single periods depending on school timetables. Assessment weeks will be confirmed by ADU throughout the term and the current distribution of weeks might need to be slightly tweaked by the teacher accordingly.

The Lesson Plans provide a model teaching strategy for Creative Design and Innovation teachers. It highlights the core points that allow teachers to support the progress of their students and it divides the lesson into phases to allow an optimum comprehension of the lessons for students. It also provides a plenty of advices for the teachers to follow in class promoting various teaching methodologies, practices and strategies. It contains answer keys for all the questions and activities within the book, in order to provide teachers with model answers that guarantee a moderate and consistent level for answers across the country.

As a CDI teacher for Grade 11 students, please encourage them to explore the revolutionary world of technology putting in mind the two core pillars of this subject, creativity and innovation. The United Arab Emirates and its leadership have always promoted these values and through CDI, they shall be adopted by the students of the Emirati school. It is also important to make sure they understand that the subject is project based. This unconventional approach does not only excite them, it also keeps them aware with regards to assessment and what they are expected to do during the term.

Please note that the Summative Assessment for this term requires the use of students' laptops **OR** computer lab with **Autodesk Fusion 360 installed**. Hence, make sure the needed facilities are well prepared ahead of **week 10**, as per the instructional planner.

Wishing you a very successful and fruitful term with your creative and innovative students!

The authors,

January 2019

Instructional Planner:

Trimester Planner (Instructional Planner)
Term two 2018/2019

SUBJECT: Creative Design and Innovation (CDI)

Grade 11 Advance

Note: All learning outcomes are essential unless highlighted in **green** they are not directly assessed but contribute to project assessment. Green Learning outcomes are non-essential.

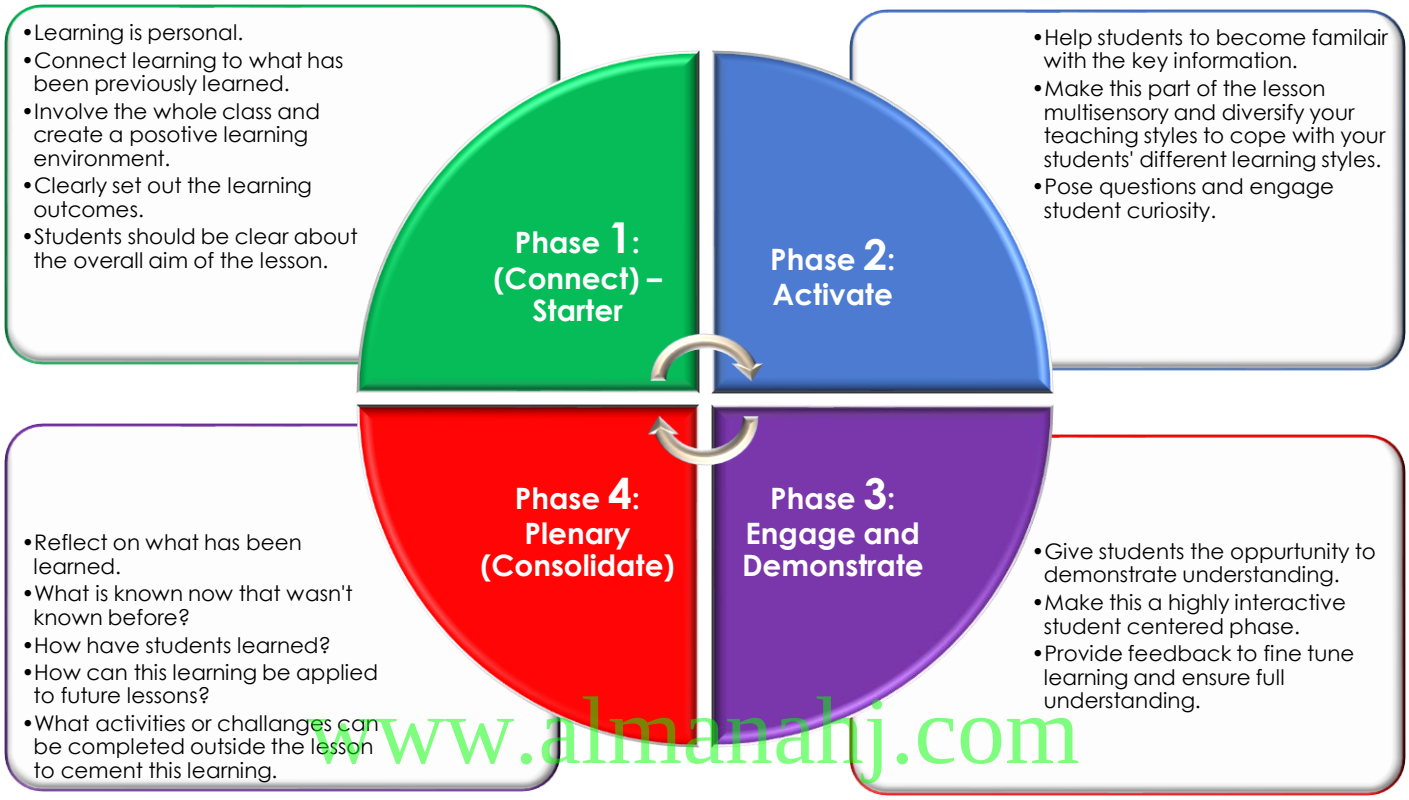
Week	Period	Chapter	Overview	Learning Outcomes
1 13/1	1 2 3	1	**Section 1:** Artificial intelligence	• Define what artificial intelligence (AI) is. • Identify everyday problems that can be solved using AI. • Compare between the different types of AI. • Experiment with different forms of AI. • Understand the shortcomings and risks of AI. • Learn what the future holds for AI.
2 20/1	1 2 3	**2**	**Section 1:** Introduction to entrepreneurship	• Describe the attributes of an entrepreneur. • Identify and record the risks and rewards of becoming an entrepreneur.
			Section 2: Design process	• Demonstrate entrepreneurial attributes throughout the project. • Demonstrate innovation, creativity and flair in your robot design. • Present your design proposal.
-	0	**3**	**Section 1:** Introducing robotics **(self-study: NOT to be assessed)**	• Understand what robotics is and why it is an important field of study. • Identify the basic components of a robot. • List the real-life applications of robots.
			Section 2: Functional and structural components of robots **(self-study: NOT to be assessed)**	• Link the robotic system to human systems. • List and differentiate between the main robotic systems. • Link robotics to embedded systems. • Identify the role of microcontrollers in embedded systems. • Identify the different types of actuators used in robotic systems. • Compare the major types of DC motors used in robotic systems.

Week	Period	Chapter	Overview	Learning Outcomes
3 27/1	1	**3**	**Section 3:** Robotic Mechanics	• Identify the different steering mechanisms used in robot drivetrains. • Differentiate between the different types of wheels used to move robot drivetrains.
	2			
	3		**Section 4:** Lifting mechanics	• List the main lifting mechanisms used in robotic systems. • Identify and compare the gears commonly used in robotic systems. • Realise the effect of gear ratio on torque and speed. • Realise the effect of gear ratio and gear reduction on gear systems. • Calculate the gear ratio and gear reduction for two gears. • Differentiate between gears and sprocket and chains. • Calculate the ratio and reduction for a sprocket and chain systems.
4 3/2	1	**3**		
	2			
	3		**Section 1:** Quick recap!	• Explain and demonstrate Autodesk Fusion 360 foundational concepts. • Navigate the toolbar in Autodesk Fusion 360. • Open and navigate the data panel in Autodesk Fusion 360.
5 10/2	1	**4**	**Section 2:** Assemble the gear drive mechanism	• Create a new project and upload files to the project. • Insert and assemble VEX IQ components. • Insert and assemble the gear base components. • Create motion links to animate the gears.
	2			
	3			
6 17/2	1	**4**	**Section 3:** Assemble the support arms	• Insert and assemble the corner connector components. • Insert and assemble the angled beam components. • Insert and assemble the beam components. • Insert and assemble the rubber band anchor components.
	2		**Section 4:** Assemble the claw arm and a claw	• Insert and assemble the large gears. • Assemble the Smart Motor onto the gear shafts. • Create motion links between the motor and the gears. • Assemble the left claw arm.
	3			
7 24/2	1	**4**	**Section 5:** Complete the assembly of the VEX IQ robot	• Insert and assemble the claws onto the assembly. • Create motion links to animate the claws. • Insert the claw arm assembly into the supplied IQ robot assembly design. • Assemble the claw arm to the robot then review the motion of the claw arm assembly.
	2			
	3		**Section 6:** Document the robot design	• Create a new drawing from the existing IQ Clawbot robot design. • Document the robot design by creating drawings of the complete assembly.
8 3/3	1	**4**	**Section 7:** Rendering and animation	• Change the appearance of components on the robot assembly. • Set the environment and lighting for the scene. • Render the scene using the cloud and local options.
	2			

Week	Period	Chapter	Overview	Learning Outcomes
	3			• Create an exploded view of the VEX IQ Smart Motor. • Publish the animation.
9 10/3	1 2 3	**4**	**Section 8:** Design a custom robot part	• Model a custom part. • Assemble the custom part onto the IQ robot.
10 17/3	1 2	**Summative Assessment Preparation** "Not decide yet. Could be a different week and will be confirmed later by ADU"		
	3	**Summative Assessment** "Not decide yet. Could be a different week and will be confirmed later by ADU		
11 24/3	1 2 3	**Continue working on CH4 tasks**		

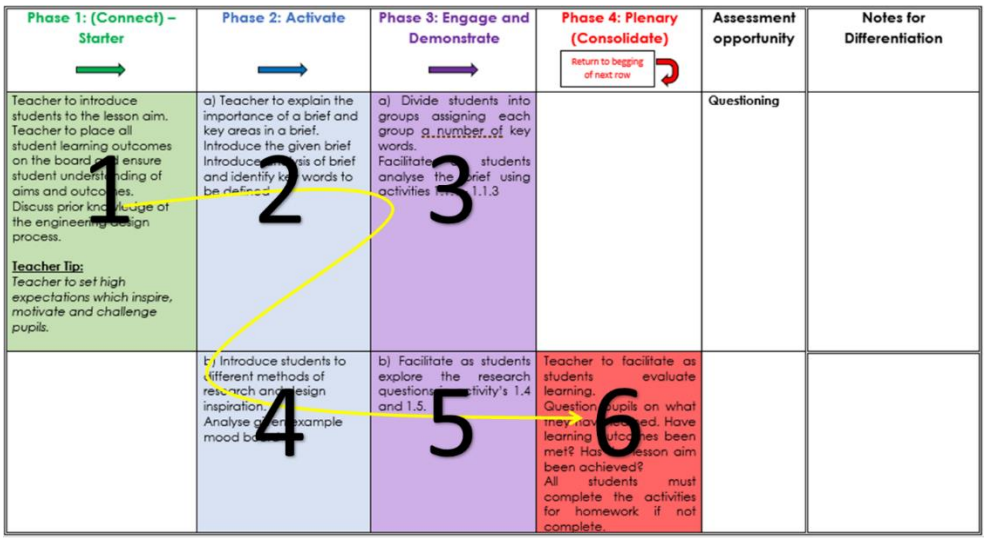
Using the provided lesson plans

Lesson plans are provided to work with the instructional Planner. The lesson plan contains 4 key learning phases. The generic lesson progression is demonstrated below, please follow the phases (clockwise).



When following the lesson plan work from left to right, completing each phase in that row before moving to the next row (see the figure below). The lesson should always begin with the **connect** phase and end with the **plenary** phase; however, the lesson may move between phases several times throughout the period.

The example figure below explains this flexibility of moving between phases for Period 1.



Notes should be made by the teacher on activities or tasks to cater for differentiation specific to your class group.

Lesson Plans:

Week 1 Lesson Plan:

Content	**Grade 11 Advance**	
	Chapter 1: Artificial intelligence	**Section 1:** Artificial intelligence
Time allocated 	**3 x 45-minute periods**	
Keywords 	**What are the keywords the students must learn?** • artificial intelligence • problem-solving • algorithm • narrow AI • general AI • machine learning • data	
Resources 	**What resources are required?** • textbooks • projector	
Prior Knowledge 	• Computer science • Robotics • Engineering	

Aim:

In this week, you will introduce students to artificial intelligence (AI), what it is, how it works and where you might apply it to your robotics project. Students must also learn the difference between narrow AI and machine learning, and the various uses of each in the real world.

Teacher Learning Objectives:

Learning objective refers to what you as a teacher will have taught the student by the end of the lesson. Teachers are to tick the box when they have covered a learning objective.

Student Learning Outcomes: Learning outcomes refer to what the student can expect from the lesson. Teachers must share these outcomes with all students. Teachers are to tick the box when the outcome is achieved. Learning outcomes can be assessed using oral questioning and the written activities.

Teacher should: *(tick as you complete)*	***Students should:*** *(tick as students complete)*
☐ Explain what artificial intelligence (AI) is.	☐ Define AI.
☐ Discuss the different problems that can be solved using AI.	☐ Identify the different applications of AI
☐ Compare between the different types of AI.	☐ Distinguish between the different types of AI
☐ Explain how AI has evolved over the years and its different applications.	☐ Identify the type of AI for different applications
☐ Introduce AI games to help students understand the concept of AI.	☐ Experiment with different forms of AI: ▪ Google AI experiments: Quick, draw! and RNN ▪ Akinator
☐ Explain the shortcomings and risks of AI.	☐ Understand the drawbacks and limitations of AI
☐ Explain the future applications of AI.	☐ Learn what the future holds for AI and identify AI future applications

Possible teaching method(s) or approach for this lesson
(teacher to tick the relevant method)

- ☐ Collaborative Teaching (student centred)
- ☐ Instructional / Demonstrative Teaching (teacher centred)
- ☐ Inquiry-based Teaching (student centred)
- ☐ Lecture Style Teaching (teacher centred)
- ☐ Coach Style Teaching (teacher centred)
- ☐ Facilitator Style Teaching (student centred)

Essential and non-essential Sections:

In some lessons it may not be possible to cover every section of the book due to time constraints or lesson variables. Below is a guideline to essential sections for examination and project knowledge.

Topic			Page	
Chapter	**Section**	**Focus**	**Essential**	**Non-essential/Self Study**
CH. 1	**Sec. 1**	Introduction to AI	14-29	-
		Local and international advancements in AI	30-33	
		Future of AI	34-36	

Learning Phases: 3 Periods

Phase 1: (Connect) – Starter	Phase 2: Activate	Phase 3: Engage and Demonstrate	Phase 4: Plenary (Consolidate) Return to the beginning of the next row	Assessment opportunity	Notes for Differentiation
Teacher to introduce students to the lesson aim. Teacher to place all student learning outcomes on the board and ensure student understanding of aims and outcomes of lesson. Teacher to assess prior knowledge of artificial intelligence. Have students seen examples in real life? Possible uses? Teacher and students should define what artificial intelligence is. Suggested starter activity: Activity 1.1.1 **Teacher Tip:** When explaining always relate back to everyday examples from their lives. Teacher to set high expectations which inspire, motivate and challenge pupils.	Teacher to introduce all key words, discuss meaning and ensure understanding before progressing. **Teacher Tip:** *Teacher can use the projector to display the vocabulary words with flashing pictures and their definitions on the board.* *Teacher can use elicitation and CCQ's after explaining the words to ensure students' understanding of the technical terms.* *Teacher also can ask the students to provide real-life examples of the key terms.* Teach to introduce the history of AI, while students research the topic. Teacher to lead the class discussion on what AI is and what are the differences between humans and robots.	**Task 1:** Ask students to find a partner and make a mind map about the different applications of AI. Students to complete Activity 1.1.4. Teacher to facilitate as peer teaching takes place. **Task 2:** Divide students into three groups and assign each group a type of AI to study. Students to complete Activities 1.1.5-1.1.8. Get students engaged by playing the "Quick, Draw" game from Google AI experiments and the Akinator game. Teacher to facilitate as peer teaching takes place.		**Questioning**	***Note:*** *All lessons can be different depending on ability and success of previous lesson. Place additional notes or activities to cater for differentiation where necessary throughout the lesson.*

	Students to complete Activities 1.1.2 - 1.1.3.	**Task 3:** Teacher introduce the concept of ML. Teacher to encourage the students to complete the research question. **Task 4:** Teacher show a video on the AI advancements in the UAE. https://www.youtube.com/watch?v=6P-5PkzC2ZI&t=10s https://www.youtube.com/watch?v=mUwmb9gDUp0 Divide students into three groups and assign each group a different application of AI (recent breakthroughs and the future of AI), give them time to read it then facilitate as peer teaching takes place. Students to complete Activities 1.1.9-1.1.10. **Task 5:** Teacher explain the drawbacks of AI and how it can be seen as a threat.			

		<u>Teacher Tip:</u> *Use groupwork as appropriate, get to know your class and organise groups to support mixed ability.*			
			Teacher to facilitate as students evaluate learning. Question pupils on what they have learned. Have learning outcomes been met? Has the lesson aim been achieved? All students must complete the official assessment tasks and reflections. Finish Chapter 1 for homework.	**Oral Assessment** **Student evaluation**	

Answer Key

QR code links:		
Page	***Topic***	***Link***
12	UAE's AI Strategy 2031	https://www.youtube.com/watch?v=6P-5PkzC2ZI
15	Google AI	https://www.youtube.com/watch?v=GoXp1leA5Qc
15	Sophia's Interview	https://www.youtube.com/watch?v=qNoTjrgMUcs
16	AlphaGo vs Ke Jie	https://www.youtube.com/watch?v=8dMFJpEGNLQ
21	AARON the painter	https://www.youtube.com/watch?v=3PA-XApZkso
21	AI music composer	https://youtu.be/36EuOivq7bM
21	Wordsmith	https://www.youtube.com/watch?v=ziizj6u1f6M
21	AI screen play writer	https://www.youtube.com/watch?v=APBJlnPIXSc
24	Driverless vehicle	https://www.youtube.com/watch?v=qgI0dJ6vRyQ
24	Autonomous flying taxi	https://www.youtube.com/watch?v=4b4tztjRJkA
25	AI Darwin learning to walk	https://www.youtube.com/watch?v=oy86Dx-N6SE
25	Google AI 'quick, draw'	https://www.youtube.com/watch?time_continue=59&v=X8v1GWzZYJ4
25	Google AI experiment	https://experiments.withgoogle.com/ai
26	Akinator	https://en.akinator.com/
27	Activity 1.1.8 – types of AI	https://www.youtube.com/watch?v=RsWbEA7XvOM
31	Tesla model x	https://www.youtube.com/watch?v=cqJQFzkZsPI
32	Google deep learning robot arm	https://www.youtube.com/watch?v=dJRap4X2fMg&t=35s
33	swarm AI'	https://www.youtube.com/watch?v=Map7nuNS0yI

Activity 1.1.1

Before we start this chapter, list all areas or tasks that a computer can perform better than humans in column A. Write the areas where humans are better in column B. Let's see if you change your answers by the end of this chapter.

Column A	Column B
• Computers are faster, good at math, better at repetition, don't need to sleep or eat, better at searching and remembering things, better for communication…	• Humans are better at emotions, creating, being original, improvising, eating…

Activity 1.1.2

A robot is only a shell hiding the technology used to power it. There are different fields of technology that help in creating machines capable of copying human actions. Using the bank of answers below, match the human action to the technology used to copy it.

Natural language processing (NLP)	Pattern recognition	Computer vision	Speech recognition	Robotics

Human	AI machine
Ability to speak and listen to communicate	Speech recognition
Ability to read and write text	NLP
Ability to see and process what they see	Computer vision
Ability to understand their environment and move around smoothly	Pattern recognition
Ability to see patterns such as the grouping of similar objects	Robotics

Activity 1.1.3

Can you identify how Siri can locate the nearest ATM machine?
Refer to the AI technologies illustrated in Activity 1.1.2.

Siri will translate your voice (speech recognition) into text, feed it into a search engine and then read you the answer back in human syntax (NLP).

Activity 1.1.4

Can you distinguish which of these two paragraphs was written by a machine?

Paragraph 1	Paragraph 2
"Tuesday was a great day for W. Roberts, as the junior pitcher threw a perfect game to carry Virginia to a 2-0 victory over George Washington at Davenport field."	"A shallow magnitude 4.7 earthquake was reported Monday morning five miles from Westwood, California, according to the U.S. geological survey."
Machine	Machine
Not a mistake, the two paragraphs were written by a machine. Use this to explain to students the level of intelligence that the machines have.	

Activity 1.1.5

1. Give two examples of where an artificially intelligent bot may perform better than a human in the customer service industry.

   Faster at providing a list of all five-star hotels in Abu Dhabi
   No waiting time to speak to a representative

2. Give two examples of where a human may perform better than an artificially intelligent bot in the customer services industry.

   Could give advice on sites to visit near a hotel
   Better with dealing with complaints, can try help the person in some way

Activity 1.1.6

1. What did you enjoy about this game?

   It was a lot of fun trying to draw the item in time while the AI bot tries to guess what you are drawing.

2. How is it showing machine learning?

   The more people play the game the more it improves at guessing items, it starts to learn and improve by itself.

3. How did you help it improve its AI by playing the game?

   By attempting to draw the various items with my own unique sketches I was adding to the AI bots database. Now it can improve and is more likely to guess correctly.

Activity 1.1.7

Can you identify which of the following examples display either narrow AI or general AI?

			
car satellite navigation	Google Quick, Draw!	self-learning robotic arm	IBM's Deep Blue chess-playing computer
narrow AI	general AI	general AI	narrow AI

Activity 1.1.8

Compare between the three types of AI. The following QR code may help you.

Narrow AI	General AI	ASI
Machines specialised in one area or has a dedicated program.	When machines or computers are as smart as humans.	When machines become smarter than humans in every field including scientific creativity, general wisdom and social skills.

Activity 1.1.9

Can you give three other examples of AI that are currently making the UAE's cities 'smarter'?

- Smart parking systems
- Smart gates at airports using Emirates ID
- Talabat food app

Activity 1.1.10

You are asked to improve the design of a game where the robot runs towards its opponent instead of avoiding it.

New design idea:

- Add a new AI to the robot that makes it "mirror" every move the opponent makes. For example, if the enemy (opponent) moves left, the robot will move right.
- Have the robot maintain a certain minimum distance from the enemy. If this minimum distance isn't maintained, and there isn't anywhere else to go, move towards the player to get unstuck until that distance is reached.

Week 2 Lesson Plan:

<table>
<tr><td rowspan="2">Content</td><td colspan="2">Grade 11 Advance</td></tr>
<tr><td rowspan="2">Chapter 2: Innovative and creative robot design</td><td>Section 1: Introduction to entrepreneurship</td></tr>
<tr><td>Section 2: Design process</td></tr>
<tr><td rowspan="2">Time allocated</td><td colspan="2">Section 1: 1 x 45-minute period</td></tr>
<tr><td colspan="2">Section 2: 2 x 45-minute periods</td></tr>
<tr><td>Keywords</td><td colspan="2">What are the keywords the students must learn?
• entrepreneurship
• teamwork
• creativity
• passion
• determination
• risk taking
• project management and Leadership
• the business model
• the target market
• client profile</td></tr>
<tr><td>Resources</td><td colspan="2">What resources are required?
• textbooks
• projector</td></tr>
<tr><td>Prior Knowledge</td><td colspan="2">• Cross-curricular transferable knowledge from business studies.
• Application of the design process.
• Sketching and 3D modelling software to illustrate creative designs.
• Application of basic engineering skills.</td></tr>
</table>

Aim:

In this week, you will introduce students to the characteristics of a good entrepreneur and to the concept of creating a business model. Students should analyse an entrepreneurial design brief for a robotics project. They should work in teams to complete the design process stages, creating a business plan to market their project idea and present it the best possible way.

Teacher Learning Objectives:

Learning objective refers to what you as a teacher will have taught the student by the end of the lesson. Teachers are to tick the box when they have covered a learning objective.

Student Learning Outcomes: Learning outcomes refer to what the student can expect from the lesson, Teachers must share these outcomes with all students. Teachers are to tick the box when the outcome is achieved. Learning outcomes can be assessed using oral questioning and the written activities.

Teacher should: *(tick as you complete)*	***Students should:*** *(tick as students complete)*
☐ Explain the attributes of an entrepreneur.	☐ Identify the attributes of a successful entrepreneur.
☐ Explain the risks and rewards of becoming an entrepreneur.	☐ Identify and record the risks and rewards of becoming an entrepreneur.
☐ Guide the students on how to create a successful business model.	☐ Demonstrate entrepreneurial attributes throughout the project.
	☐ Demonstrate innovation, creativity and flair in the robot design.
☐ Explain the key skills needed to deliver a successful presentation.	☐ Present the design proposal.

Possible teaching method(s) or approach for this lesson
(teacher to tick the relevant method)

- ☐ Collaborative Teaching (student centred)
- ☐ Instructional / Demonstrative Teaching (teacher centred)
- ☐ Inquiry-based Teaching (student centred)
- ☐ Lecture Style Teaching (teacher centred)
- ☐ Coach Style Teaching (teacher centred)
- ☐ Facilitator Style Teaching (student centred)

Essential and non-essential Sections:

In some lessons it may not be possible to cover every section of the book due to time constraints or lesson variables. Below is a guideline to essential sections for examination and project knowledge.

Topic			Page	
Chapter	**Section**	**Focus**	**Essential**	**Non-essential/Self Study**
CH. 2	**Sec. 1**	What is an entrepreneur?	42	-
		Risk vs Reward	43	
		Problems that entrepreneurs often face	43	
		Entrepreneurship in the UAE	44	
	Sec. 2	Design of your robot	48-49	
		Design process stages	50-67	

Learning Phases: Section 1 – 1 Period

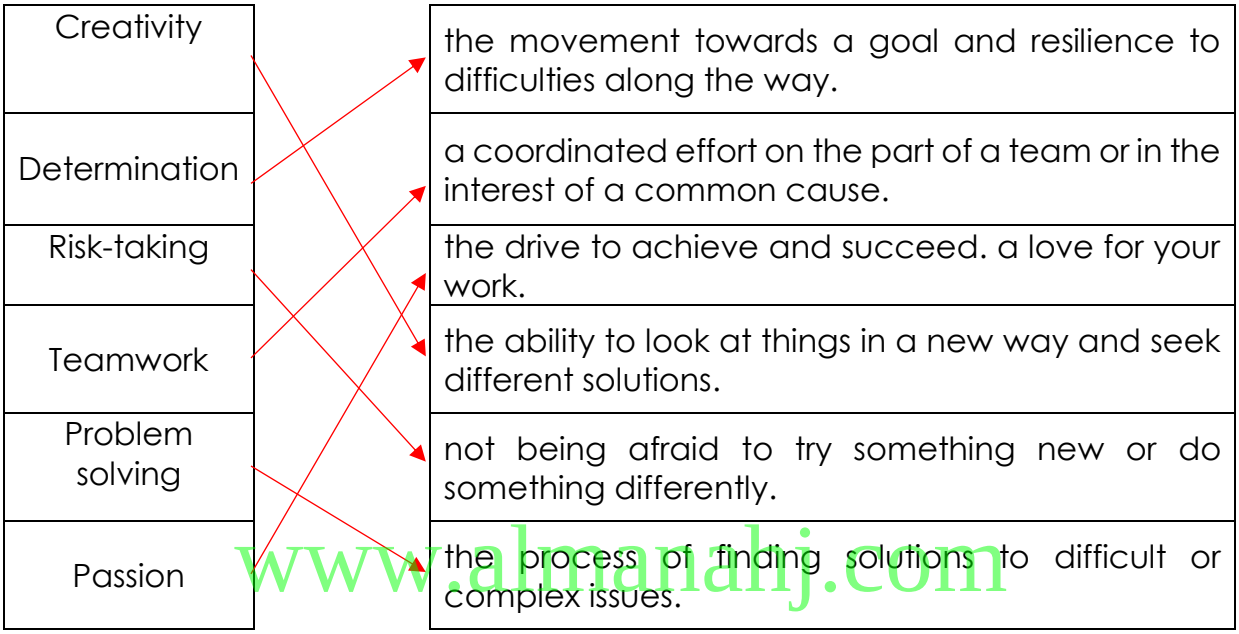
Phase 1: (Connect) – Starter	Phase 2: Activate	Phase 3: Engage and Demonstrate	Phase 4: Plenary (Consolidate)	Assessment opportunity	Notes for Differentiation
Teacher to introduce students to the lesson aim. Teacher to place all student learning outcomes on the board and ensure student understanding of aims and outcomes of lesson. Teacher to assess prior knowledge of entrepreneurship. *What is an entrepreneur? What do they do? Do you know any examples of entrepreneurs?* Teacher and students should define what an entrepreneur is. Suggested starter activity: Activity 2.1.1 **Teacher Tip:** When explaining always relate back to everyday examples from their lives. Teacher to set high expectations which inspire, motivate and challenge pupils.	Once students have completed activity 2.1.1 the teacher should recap on this activity ensuring students are clear on the attributes of an entrepreneur. **Teacher Tip:** *Teacher can use the projector to display the entrepreneurship attributes on the board and referred to throughout the lesson.* *Teacher can use elicitation and CCQ's after explaining the attributes to ensure students' understanding of the technical terms.* *Teacher also can ask the students to provide real-life examples of the key terms.* Teach to introduce the history of AI, while students research the topic.	**Task 1:** Ask students to find a partner and let them discuss the advantages and disadvantages of starting their own business and the expected risks and rewards of being an entrepreneur. Teacher facilitate as peer teaching takes place. Students to complete Activity 2.1.2. **Task 2:** Give students time to read 'entrepreneurship in the UAE'. Then have a group discussion about the business opportunities the UAE provides.	Return to the beginning of the next row	**Questioning**	***Note:*** *All lessons can be different depending on ability and success of previous lesson. Place additional notes or activities to cater for differentiation where necessary throughout the lesson.*

	Teacher to lead the class discussion on what AI is and what are the differences between humans and robots. Students to complete Activity 1.1.2.				
			Teacher to facilitate as students evaluate learning. Question pupils on what they have learned. Have learning outcomes been met? Has the lesson aim been achieved? All students must complete the official assessment tasks and reflections.	**Oral Assessment** **Student evaluation**	

Answer Key

Activity 2.1.1

Before we start this chapter, below is a list of **essential entrepreneurial attributes** that an entrepreneur must possess. Can you match the attributes on the left with the correct descriptions on the right using arrows? The first one has been completed for you as an example.



Activity 2.1.2

From the list below, chose which you consider a risk or a reward of becoming an entrepreneur? Write each of the consequences in the appropriate box.

- Independence
- Financial failure
- Increased income
- Personal life sacrifices
- Creativity and new challenges
- Self-satisfaction in your work
- Stress

Risks	Rewards
financial failure stress sacrifices to your personal life	self-satisfaction with your work creativity and new challenges increased income independence

Learning Phases: Section 2 – 2 Periods

Phase 1: (Connect) – Starter	Phase 2: Activate	Phase 3: Engage and Demonstrate	Phase 4: Plenary (Consolidate) Return to the beginning of the next row	Assessment opportunity	Notes for Differentiation
Teacher to introduce students to the lesson aim. Teacher to place all student learning outcomes on the board and ensure student understanding of aims and outcomes of lesson. Discuss prior knowledge of the engineering design process. **Teacher Tip:** *Teacher to set high expectations which inspire, motivate and challenge pupils.*	**Task 1:** Teacher to introduce students to the unit project. Go through the design process stages and explain the business model structure. Give students five minutes to form their teams. **Task 2:** Teacher to explain the importance of a brief and key areas in a brief. Introduce the given brief and identify key words.	Divide students into groups assigning each group a number of key words. Facilitate as students analyse the brief using activities 2.2.1 – 2.2.3		**Questioning**	***Note:*** *All lessons can be different depending on ability and success of previous lesson. Place additional notes or activities to cater for differentiation where necessary throughout the lesson.*
	Task 3: Ask the teams to brainstorm ideas/solutions to solve a problem in the sector of their choice.	Students should represent their ideas using a mind map or a spidergram, as in activity 2.2.4.			
	Task 4: Introduce students to different methods of research and investigation.	Teacher facilitate as students explore the research questions in activity's 2.2.5 – 2.2.8.			

	Explain how to conduct a market research. Teacher and students should define what is meant by client profile and company's brand. Then discuss why it's important to consider these when creating a business model. **well branded companies:** https://youtu.be/JKIAOZZritk				
	Task 5: The teacher and students should discuss the important questions to consider during the investigation stage. Students are required to investigate **at least three** essential requirements of their chosen design. These questions will be developed from the brainstorming session and mind mapping in the analysis of brief or from the group discussion.	Students can present their work as a mood board or as a research paper. **Teacher Tip:** It would be a very good idea to have students get a folder to store all their work. Or have somewhere safe they can store it before its transferred to the book. Teacher facilitate as students complete activity 2.2.9.			
		Notes: • Using images and freehand sketches is a clever way of presenting investigation. • A mood board is a great way to represent where students got their inspiration. • Virtually any conceivable method of presentation can be used to convey the thought process • Images from books, catalogues and the internet are fine, but they must be accompanied by short notes describing their purpose. • If your students have prior knowledge of any word processing/desktop publishing software they could use it here.			

		• Images and annotations together give a distinct representation of the research undertaken. • Students may include extra pages to accompany their book for this section. • **Try to be as creative and unique as possible.** **Why are annotations/ notes important to accompany images and sketches throughout this project?** These annotations are where the real 'critical thinking' takes place. They should be found throughout the project. They demonstrate a good understanding for the various design features. **What are mood boards?** As mentioned above a mood board is a great way to represent where students got their inspiration. A mood board is an arrangement of images, materials or text which is used for inspiration for a new design concept. Designers often use mood boards as inspiration for creativity, a good starting point for their design.			
	Task 6: Using the information gathered, students should sketch at least two possible solutions. They can use several sketching techniques. Possible solutions must: - explain the operation of the design solution. - state advantages and disadvantages of each solution. - Show how it meets the brief. **Teacher Tip:** It would be a good idea to photocopy this section out of book for students to	When it comes to sketching, the more practice our students get the more they improve as designers. Students should be encouraged to practice their sketching techniques if they get any spare time in school or at home. Youtube is full of videos on sketching techniques, if students wish to practice at home. **Sketching exercise** You could get students practising how to sketch basic shapes using the video exercise below. https://www.youtube.com/watch?v=6ZU-ryDOtLw&t=22s			

	practice on and show you their attempts before they transfer into book	Teacher facilitate as students complete design idea 1 and 2. Students to complete sketching at home.			
		Notes: **How should my students present their work?** The layout of the sketches is up to the student, they can have a single sketch to present their ideas or several sketches. Students should be encouraged to consider the following: • All sketches should be very neat and tidy. The use of colour and shading is encouraged. • A combination of 2D and 3D sketches will be a better representation. • Neat annotations or notes would help in explaining the operation of student designs. • Students should give at least two advantages and two disadvantages to each design. • Students may include extra pages to accompany their book for this section. **What guidance can I give my students for possible solutions?** • Look at the details in students research • Pay attention to colour, shape, texture, material…			
	<u>Task 7:</u> Students should select a final solution as their design idea.	Students may select the final design based on one of the possible solutions or a mixture of possible solutions. It is important that students show the reasons for choosing one solution over another. The way students present their work will be quite similar to the previous section. Students to complete sketching at home.			

	Stages 5 and 6 of the design process to be completed after assembling the clawbot on Fusion 360.				
			Teacher to facilitate as students evaluate learning. Question pupils on what they have learned. Have learning outcomes been met? Has the lesson aim been achieved? All students must complete the official assessment tasks and reflections.	**Oral Assessment** **Student evaluation**	

Answer Key

QR code links:		
Page	***Topic***	***Link***
56	Well-branded companies	https://www.youtube.com/watch?v=JKIAOZZritk
57	Activity 2.2.8	https://www.youtube.com/watch?v=_n0_FmqttJk

Activity 2.2.1

Highlight or circle keywords and phrases in the brief. This will help to break down the design one step at a time. List five of these keywords below and describe their meaning. *Answers may vary.*

Keyword	Meaning
innovative	*A new idea that is creative*
entrepreneurship	*to develop, organise and manage a business venture*
robot	*is a machine that can carry out a complex series of actions*
assemble	*to join parts together*

In all activities, answers may vary please refer to the LP for guidance.

Week 3 Lesson Plan:

<table>
<tr><td rowspan="3">Content</td><td colspan="2">Grade 11 Advance</td></tr>
<tr><td rowspan="3">Chapter 3: Introduction to robotics</td><td>Remember, sections 1 and 2 of chapter 3 are self-study</td></tr>
<tr><td>Section 3: Robotic mechanics</td></tr>
<tr><td>Section 4: Lifting mechanics (part 1)</td></tr>
<tr><td rowspan="2">Time allocated</td><td colspan="2">Section 3: 2 x 45-minute periods</td></tr>
<tr><td colspan="2">Section 4: 3 x 45-minute periods (to be continued in periods 1 and 2 of week 4)</td></tr>
<tr><td>Keywords</td><td colspan="2">What are the keywords the students must learn?</td></tr>
<tr><td></td><td colspan="2">• skid steering
• traction wheels
• omni wheels
• mecanum wheels
• gear
• spur gear
• driver gear
• driven gear
• idler gear
• bevel gear
• sprocket gear
• compound gear
• gear ratio
• gear reduction</td></tr>
<tr><td>Resources</td><td colspan="2">What resources are required?
• textbooks
• projector</td></tr>
<tr><td>Prior Knowledge</td><td colspan="2">• Identify what robotic drivetrains are.
• Calculate the ratio between two quantities.
• Differentiate between torque and speed.</td></tr>
</table>

Aim:

In this week, you will introduce students to the various steering mechanisms used in robot drivetrains. You will also explain to them the most common types of wheels, types of gears and how they are used as robotic lifting mechanisms.

Teacher Learning Objectives:

Learning objective refers to what you as a teacher will have taught the student by the end of the lesson. Teachers are to tick the box when they have covered a learning objective.

Student Learning Outcomes: Learning outcomes refer to what the student can expect from the lesson, Teachers must share these outcomes with all students. Teachers are to tick the box when the outcome is achieved. Learning outcomes can be assessed using oral questioning and the written activities.

Teacher should: *(tick as you complete)*	***Students should:*** *(tick as students complete)*
☐ Explain the different steering mechanisms used in robot drivetrains	☐ Identify the different steering mechanisms (car-style, skid and crab steering mechanisms).
☐ Explain the different types of wheels used to move robot drivetrains	☐ Differentiate between the different types of wheels.
☐ Explain the lifting mechanisms used in robotic system.	☐ List the main robot lifting mechanisms.
☐ Explain the different types of gears and how to calculate gear ratios.	☐ Identify and compare the gears commonly used in robotic systems.
	☐ Realise the effect of gear ratio on torque and speed.
	☐ Realise the effect of gear ratio and gear reduction on gear systems.
	☐ Calculate the gear ratio and gear reduction for two gears.
	☐ Differentiate between gears and sprocket and chains.
	☐ Calculate the ratio and reduction for a sprocket and chain systems.

Possible teaching method(s) or approach for this lesson
(teacher to tick the relevant method)

- ☐ Collaborative Teaching (student centred)
- ☐ Instructional / Demonstrative Teaching (teacher centred)
- ☐ Inquiry-based Teaching (student centred)
- ☐ Lecture Style Teaching (teacher centred)
- ☐ Coach Style Teaching (teacher centred)
- ☐ Facilitator Style Teaching (student centred)

Essential and non-essential Sections:

In some lessons it may not be possible to cover every section of the book due to time constraints or lesson variables. Below is a guideline to essential sections for examination and project knowledge.

Topic			Page	
Chapter	**Section**	**Focus**	**Essential**	**Non-essential/Self Study**
CH. 3	**Sec. 1**	History of robotics		74-77
		What is robotics?		78-79
		Why is robotics important?		80
		Basic components of a robot		81-84
		Uses and examples of robots		85-87
	Sec. 2	The philosophy of robotics		91-94
		Microcontrollers		95-98
		Actuators		98-105
	The answer key for the non-essential activities are provided in the TG in case student wanted to explore the self-study sections.			
	Sec. 3	Drivetrains	108-110	
		Wheels	111-114	
	Sec. 4	Lifting mechanisms	118	
		Gears	119-128	

Learning Phases: Section 3 – 2 Periods

Phase 1: (Connect) – Starter	Phase 2: Activate	Phase 3: Engage and Demonstrate	Phase 4: Plenary (Consolidate) Return to the beginning of the next row	Assessment opportunity	Notes for Differentiation
Teacher to introduce students to the lesson aim. Teacher to place all student learning outcomes on the board and ensure student understanding of aims and outcomes of lesson. **Teacher Tip:** When explaining always relate back to everyday examples from their lives. Teacher to set high expectations which inspire, motivate and challenge pupils.	Teacher to introduce all key words, discuss meaning and ensure understanding before progressing. **Teacher Tip:** *Teacher can use the projector to display the vocabulary words with flashing pictures and their definitions on the board.* *Teacher can use elicitation and CCQ's after explaining the attributes to ensure students' understanding of the technical terms.*	**Task 1:** Divide the students into groups, assign each group a type of steering mechanism to read and study. **Teacher Tip:** *Teacher can use fun applications to form groups, for example, the 'Team Shake' app. All the teacher needs to do is enter the students name list and the number of groups to form and the app will for the teams randomly.* https://itunes.apple.com/us/app/team-shake/id390812953?mt=8 Each group should share with the class what they understood from what they read. The teacher should recap on this activity ensuring students are clear on the different types of steering mechanism.		**Questioning**	***Note:*** *All lessons can be different depending on ability and success of previous lesson. Place additional notes or activities to cater for differentiation where necessary throughout the lesson.*

		Students to complete activities 3.3.1 - 3.3.3. **<u>Task 2:</u>** Teacher to explain the types of wheels using compare and contrast strategy to identify the similarities and differences between the different wheel types. Students to complete activities 3.3.4 and 3.3.5 in groups. **<u>Teacher Tip:</u>** *Use groupwork as appropriate, get to know your class and organise groups to support mixed ability.*			
			Teacher to facilitate as students evaluate learning. Question pupils on what they have learned. Have learning outcomes been met? Has the lesson aim been achieved? All students must complete the official assessment tasks and reflections.	**Oral Assessment** **Student evaluation**	

Answer Key

QR code links:		
Page	**Topic**	**Link**
Pg. 108	Zero Radius Turning, Four wheel steering, engineering Projects Activity 3.3.1	https://www.youtube.com/watch?v=IksiJC4uLyU
Pg. 110	Crab Drive Test with Bump Activity 3.3.3	https://www.youtube.com/watch?v=q9uck-wRa_8
Pg. 111	Toyota Traction Control System (TRC)	https://www.youtube.com/watch?v=iBU2n-HI2oM

Activity 3.3.1

- Scan the QR code and answer the question below.
- What are the advantages of using a zero turning radius steering mode? Can you think of real-life applications for it? List them in the space below.

Mainly, reducing the turning radius allows the vehicle to smoothly rotate in narrow areas.
Answers will vary: parking cars in narrow parking lots.

Activity 3.3.2

- Use the list above to identify the manoeuvring techniques the robot is using in the images below.

Left: Manoeuvre 2 – Right: Manoeuvre 3

Activity 3.3.3

- Scan the QR code and answer the question below.
- What are the advantages of using crab drive in robots? Can you think of real-life applications for it? List them in the space below.

Mainly, allows the vehicle movement to be more flexible.
Answers will vary: avoiding obstacles.

Activity 3.3.4

- Match the directions on the right with the correct 4-wheel omnidirectional-wheel robot.

4	
1	
3	
2	

Activity 3.3.5

- Two robot drivetrains below are missing their directions. Write the number of the direction in the correct box below.

The upper image :1 – The lower image: 2

Learning Phases: Section 4 – 3 Periods *(1 period in W3 and 2 periods in W4)*

Phase 1: (Connect) – Starter	Phase 2: Activate	Phase 3: Engage and Demonstrate	Phase 4: Plenary (Consolidate)	Assessment opportunity	Notes for Differentiation
Teacher to introduce students to the lesson aim. Teacher to place all student learning outcomes on the board and ensure student understanding of aims and outcomes of lesson. **Teacher Tip:** When explaining always relate back to everyday examples from their lives. Teacher to set high expectations which inspire, motivate and challenge pupils.	Teacher to introduce all key words, discuss meaning and ensure understanding before progressing. **Teacher Tip:** *Teacher can use the projector to display the vocabulary words with flashing pictures and their definitions on the board.* *Teacher can use elicitation and CCQ's after explaining the attributes to ensure students' understanding of the technical terms.*	**Task 1:** Teacher explain the lifting mechanism used in robotic systems. **Task 2:** Teacher introduce the different types of gear. Then explain the 1st type, the spur gears. Teacher explain how gear ratios work. Students to complete activity 3.4.1 in groups. **Teacher Tip:** *Use groupwork as appropriate, get to know your class and organise groups to support mixed ability.* **Task 3:** Teacher explain the compound gear structure and explain how the gear ratio calculations change when using compound gears.	Return to the beginning of the next row	**Questioning**	***Note:** All lessons can be different depending on ability and success of previous lesson. Place additional notes or activities to cater for differentiation where necessary throughout the lesson.*

		Students complete activity 3.4.2. **<u>Task 4:</u>** Teacher explain the bevel and sprocket gears. Divide the students into groups and ask them to complete activity 3.4.3.			
			Teacher to facilitate as students evaluate learning. Question pupils on what they have learned. Have learning outcomes been met? Has the lesson aim been achieved? All students must complete the official assessment tasks and reflections.	**Oral Assessment** **Student evaluation**	

Answer Key

Activity 3.4.1

- How can you get a 1:25 gear ratio using a 12-teeth driver gear? Calculate the number of teeth for the output gear.

$$\text{gear ratio} = \frac{input}{output}$$

$$\frac{1}{25} = \frac{12}{output}$$

$$\text{output gear teeth} = 12 \times 25 = 300\ teeth$$

Activity 3.4.2

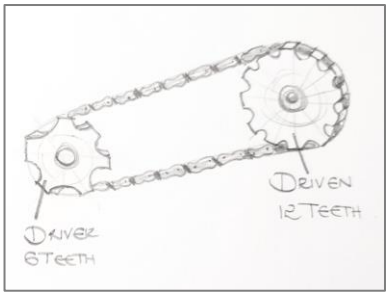
- Match the system properties below with the correct driver and driven gears used for making them.

3
2
1

Activity 3.4.3

- Sketch a sprocket and chain system below. Your system's ratio should be 6:12. You need to label the driver and driven gears.
- Calculate the reduction for this system.

Answers will vary.



$$\text{gear reduction} = \frac{output}{input} = \frac{12}{6} = 2$$

Note: Students can draw any other system that has the same ratio like 12 input teeth and 24 output teeth. In all scenarios, the reduction will always be 2.

Answer Key/ Resources

NOTE: Lessons 1-2 are self-study

Section 1

QR code links:		
Page	**Topic**	**Link**
Pg. 78	Robotic Surgery	https://www.youtube.com/watch?v=H-sOLL9cz_g

Activity 3.1.1

- Classify the images below as either machines or robots. Put the numbers in the boxes below?

Machines			Robots		
2	3	5	1	4	6

Activity 3.1.2

- Use your own words to write a definition for the term 'robotics'.

Answers may vary.
Robotics is the study of robots. It's a branch of engineering and computer science that studies robots that are able to perform different tasks responding to sensory input programmed by a human.

- List three examples of where robots are used to help people.

Answers may vary.
1- Car production and assembly lines
2- Space/ underwater exploration
3- Military for transportation and bomb disposal
4- Entertainment

Activity 3.1.3

- Research the inventors of the first robots and document your research below.

Answers may vary.
Example of inventors to research:
1- Ctesibius an ancient Greek engineer - 270 B.C.
2- William Grey Walter
3- George Devol

Activity 3.1.4

- Label the image with the correct type of drivetrain. You will need to research these types of drivetrains online?

1- Tank
2- Slide
3- Swerve
4- Mecanum

Sections 2

QR code links:		
Page	**Topic**	**Link**
Pg. 100	DC motor parts	https://ibb.co/cDbv6S
Pg. 101	How DC motor works? Activity 2.2	https://www.youtube.com/watch?v=7bb7vQl3wpQ
Pg. 105	Single and Double-acting Cylinders in a Fluid System Activity 3.2.5	https://www.youtube.com/watch?v=WEWxG2T9xuQ

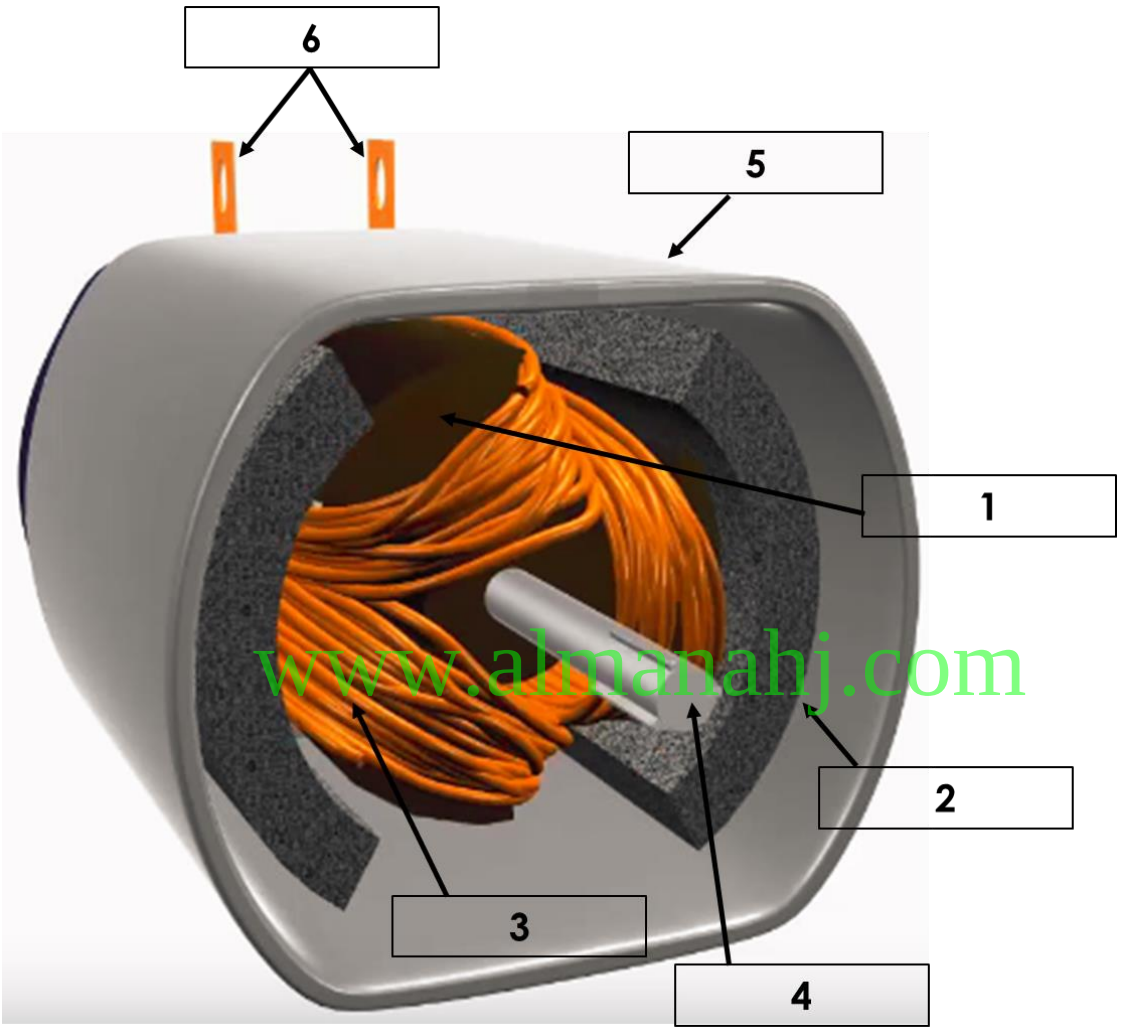
Activity 3.2.1

- Match the following robotic peripherals to the related human system.

2	obstacle detector	1	skeletal system
1	metallic rails/plates/bars	2	nervous system
3	servo motor	3	muscular system

Activity 3.2.2

- Fill in the boxes below with the correct label.



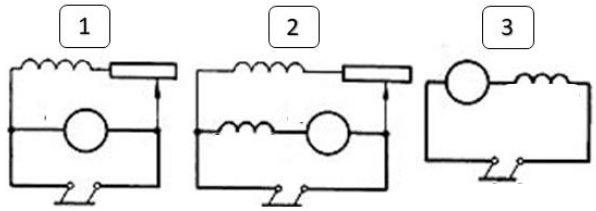
Activity 3.2.3

- Speed varies widely between no load and full load.
- The motor cannot be used where a constant speed is required with varying loads.

✓	Series DC motor		Shunt DC motor

Activity 3.2.4

- Match the three schematic diagrams below with the correct DC motor type.



series	3	shunt	1	compound	2

Activity 3.2.5

- What type of actuators are presented?

  b

- How many ports does each type of actuator have?

  c

- All pneumatic cylinders provide rotational movement because they have a cylindrical shape.

  b

Week 4 Lesson Plan:

Content	**Grade 11 Advance**	
	Chapter 3: Introduction to robotics	**Section 4:** Lifting mechanics (part 2)
	Chapter 4: Design and customise an IQ CLAWBOT	**Section 1:** Quick recap!
Time allocated	**Section 4 (CH3): 2 x 45-minute periods** (refer to the LP in W3)	
	Section 1 (CH4): 1 x 45-minute period	
Keywords	**What are the keywords the students must learn?**	
	• CAD • CAM • Autodesk Fusion 360	
Resources	**What resources are required?** • textbooks • projector • Fusion 360 software	
Prior Knowledge	• Recognise the user interface of Autodesk Fusion 360.	

Aim:

In this lesson, you will give a quick recap of the Autodesk Fusion 360 workspace. Students should reexplore Fusion 360 core concepts and navigate its different toolbars and menus.

Teacher Learning Objectives:

Learning objective refers to what you as a teacher will have taught the student by the end of the lesson. Teachers are to tick the box when they have covered a learning objective.

Student Learning Outcomes: Learning outcomes refer to what the student can expect from the lesson, Teachers must share these outcomes with all students. Teachers are to tick the box when the outcome is achieved. Learning outcomes can be assessed using oral questioning and the written activities.

Teacher should: *(tick as you complete)*	***Students should:*** *(tick as students complete)*

☐ Recap of Fusion 360 user interface.	☐ Identify and demonstrate Autodesk Fusion 360 foundational concepts.
	☐ Navigate the toolbar in Autodesk Fusion 360.
	☐ Open and navigate the data panel in Autodesk Fusion 360.

Possible teaching method(s) or approach for this lesson
(teacher to tick the relevant method)

- ☐ Collaborative Teaching (student centred)
- ☐ Instructional / Demonstrative Teaching (teacher centred)
- ☐ Inquiry-based Teaching (student centred)
- ☐ Lecture Style Teaching (teacher centred)
- ☐ Coach Style Teaching (teacher centred)
- ☐ Facilitator Style Teaching (student centred)

Essential and non-essential Sections:

In some lessons it may not be possible to cover every section of the book due to time constraints or lesson variables. Below is a guideline to essential sections for examination and project knowledge.

Topic			Page	
Chapter	**Section**	**Focus**	**Essential**	**Non-essential/Self Study**
CH. 4	**Sec. 1**	Autodesk Fusion 360 user interface	133-134	
		Autodesk Fusion 360 Data panel	135	

Learning Phases: Section 1 – 1 Period

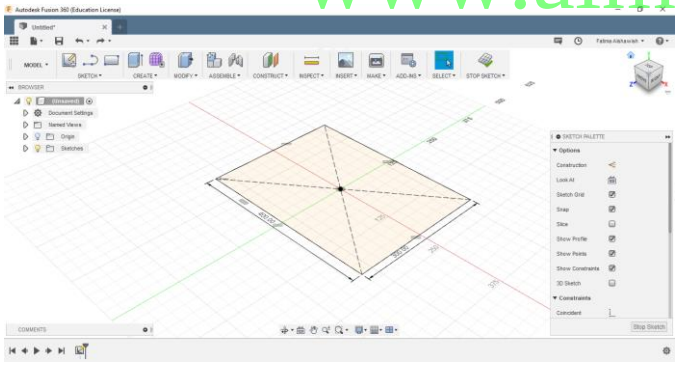
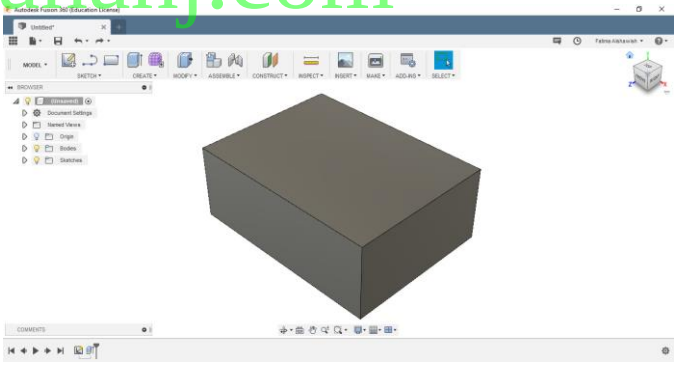
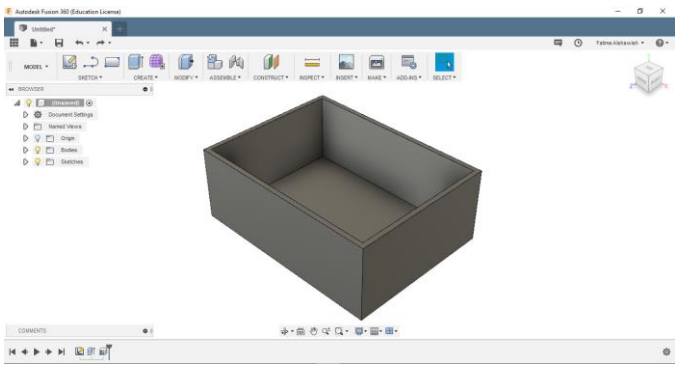
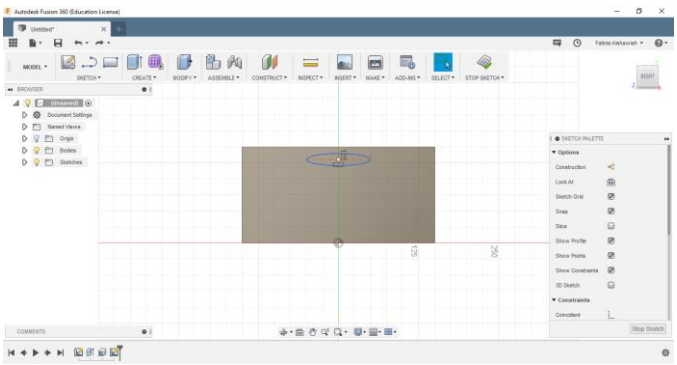
Phase 1: (Connect) – Starter	Phase 2: Activate	Phase 3: Engage and Demonstrate	Phase 4: Plenary (Consolidate) Return to the beginning of the next row	Assessment opportunity	Notes for Differentiation
Teacher to introduce students to the lesson aim. Teacher to place all student learning outcomes on the board and ensure student understanding of aims and outcomes of lesson. Discuss prior knowledge of Fusion 360 or other CAD programs **Teacher Tip:** When explaining always relate back to everyday examples from their lives. Teacher to set high expectations which inspire, motivate and challenge pupils.	**Task 1:** Teacher to introduce all key words, discuss meaning and ensure understanding before progressing. **Task 2:** Teacher to give students time to reexplore the Fusion 360 workspace, guide them on how to use the main tools, and help them when needed.	Divide the students into groups, ask them to complete activity 4.1.1. **Teacher Tip:** *Use groupwork as appropriate, get to know your class and organise groups to support mixed ability.*		**Questioning**	***Note:*** *All lessons can be different depending on ability and success of previous lesson. Place additional notes or activities to cater for differentiation where necessary throughout the lesson.*
			Teacher to facilitate as students evaluate learning. Question pupils on what they have learned. Have learning outcomes been met? Has the lesson aim been achieved? All students must complete the official assessment tasks and reflections.	**Oral Assessment** **Student evaluation**	

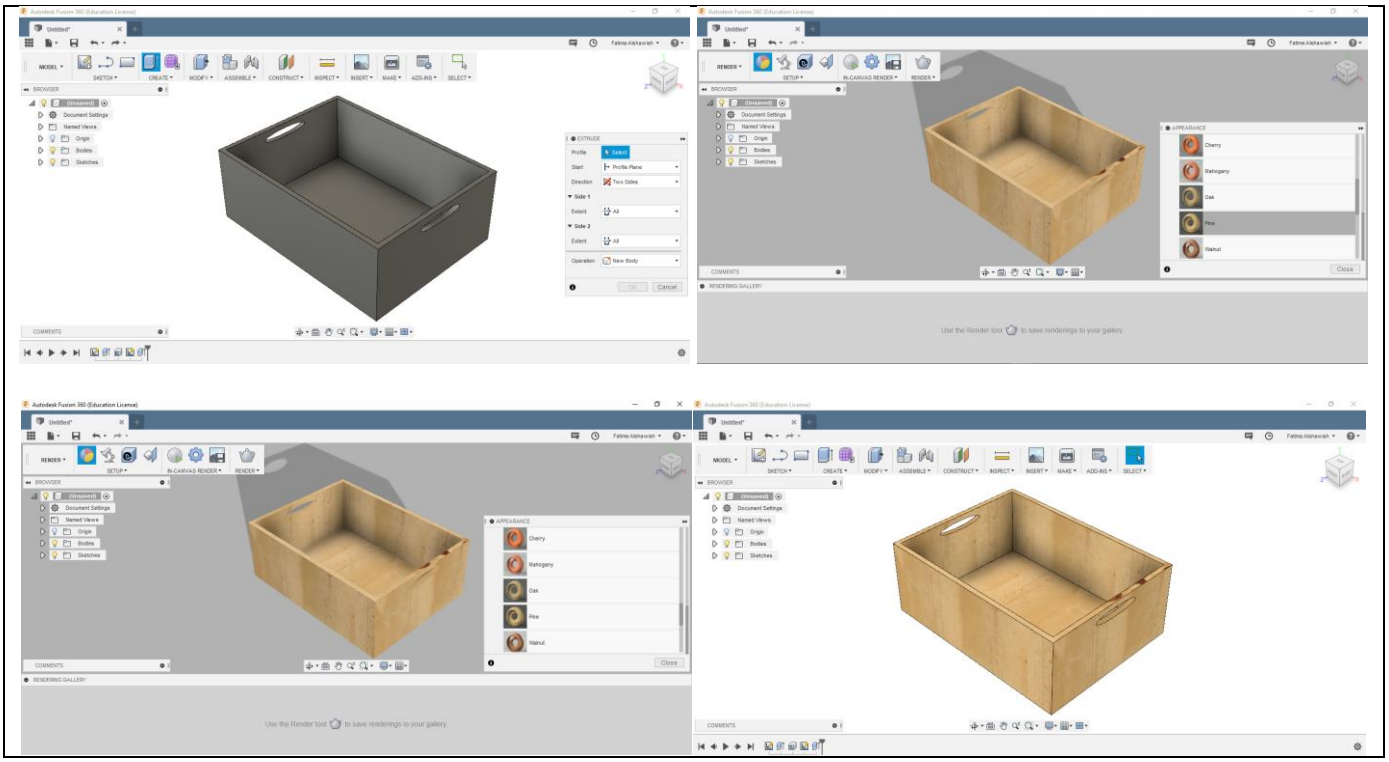
Answer Key

Activity 4.1.1

- Using your knowledge of Autodesk Fusion 360, write the steps needed to achieve the design shown in the image below. You can also simply paste a picture of your Autodesk Fusion 3D design in the space below.

- Sketch 'centre rectangle'
  Dimensions: length 300mm, width 400mm
- From 'create' dropdown menu → Extrude 150mm
- From 'modify dropdown menu → Shell 10mm
- Sketch an 'ellipse' on the side surface of the box
- From 'create' dropdown menu → Extrude → select the ellipse surface
  The setting should be:
  Direction: 2 sides
  Extent: All
- Change the workspace to render
  Click on 'appearance'
  From the menu select 'wood' → drag and drop it on the box to change the material



Week 5 Lesson Plan:

Content	**Grade 11 Advance**	
	Chapter 4: Design and customise an IQ CLAWBOT	**Section 2:** Assemble the gear drive mechanism
Time allocated 	**Section 2: 3 x 45-minute periods**	
Keywords 	**What are the keywords the students must learn?**	
	• Joint • Animate	
Resources 	**What resources are required?** • textbooks • projector • Fusion 360 software	
Prior Knowledge 	• Recognise the user interface of Fusion 360.	

Aim:

In this week, students will start the assembly of a VEX IQ claw arm. They should follow the instructions to insert robot components into a new design then assemble them using joints.

Teacher Learning Objectives:

Learning objective refers to what you as a teacher will have taught the student by the end of the lesson. Teachers are to tick the box when they have covered a learning objective.

Student Learning Outcomes: Learning outcomes refer to what the student can expect from the lesson, Teachers must share these outcomes with all students. Teachers are to tick the box when the outcome is achieved. Learning outcomes can be assessed using oral questioning and the written activities.

Teacher should: *(tick as you complete)*	***Students should:*** *(tick as students complete)*
☐ Guide the students on how to assemble the gear drive mechanism.	☐ Create a new project and upload files to the project.
	☐ Insert and assemble VEX IQ components.
	☐ Insert and assemble the gear base components.
	☐ Create motion links to animate the gears.

Possible teaching method(s) or approach for this lesson

(teacher to tick the relevant method)

- ☐ Collaborative Teaching (student centred)
- ☐ Instructional / Demonstrative Teaching (teacher centred)
- ☐ Inquiry-based Teaching (student centred)
- ☐ Lecture Style Teaching (teacher centred)
- ☐ Coach Style Teaching (teacher centred)
- ☐ Facilitator Style Teaching (student centred)

Essential and non-essential Sections:

In some lessons it may not be possible to cover every section of the book due to time constraints or lesson variables. Below is a guideline to essential sections for examination and project knowledge.

Topic			Page	
Chapter	**Section**	**Focus**	**Essential**	**Non-essential/Self Study**
CH. 4	**Sec. 2**	Design steps	139-158	

Learning Phases: Section 2 – 3 Periods

Phase 1: (Connect) – Starter	Phase 2: Activate	Phase 3: Engage and Demonstrate	Phase 4: Plenary (Consolidate) Return to the beginning of the next row	Assessment opportunity	Notes for Differentiation
Teacher to introduce students to the lesson aim. Teacher to place all student learning outcomes on the board and ensure student understanding of aims and outcomes of lesson. **Teacher Tip:** When explaining always relate back to everyday examples from their lives. Teacher to set high expectations which inspire, motivate and challenge pupils.	**Task 1:** Teacher to introduce all key words, discuss meaning and ensure understanding before progressing. **Task 2:** Teacher to introduce the project to the students. **Teacher tip:** Teacher can show the students the final assembly of the Clawbot to motivate them to start their own assembly.	Teacher to make sure Autodesk Fusion 360 is downloaded on the students' laptops or in the computer/CDI lab.		**Questioning**	***Note:*** *All lessons can be different depending on ability and success of previous lesson. Place additional notes or activities to cater for differentiation where necessary throughout the lesson.*
	Task 3: Teacher to demonstrate how to create a new project in Fusion, uploaded the required files and insert components into the current design. **Task 4:** Students are expected to individually assemble the clawbot following the steps in the book. The teacher should only provide	Students should complete all steps and paste a picture of their finished assembly as an evidence (activity 4.2.1). **Teacher Tip:** Teacher to demonstrate good subject and curriculum knowledge.			

	guidance and help when needed. **<u>Task 5:</u>** Teacher to monitor the students' progress throughout the lesson by using the different assessment opportunities. **<u>Teacher tip:</u>** If it's not possible for students to work individually due to lack of resources, divide the students into groups (as small as possible), ask them to work together in the assembly. *Teacher to facilitate as peer teaching takes place.*				
			Teacher to facilitate as students evaluate learning. Question pupils on what they have learned. Have learning outcomes been met? Has the lesson aim been achieved? All students must complete the official assessment tasks and reflections.	**Oral Assessment** **Student evaluation**	

Answer Key

QR code links:		
Page	**Topic**	**Link**
Pg. 139	Finished assembly - Sec 2	https://moeae87206-my.sharepoint.com/:v:/g/personal/fatima_shawish_moe_ae/EVL4hqVXDLFHmJIVvHtv0ZYBAd2_EbjfGZtqWU0VjSJD2w?e=Ty0Ocg

Week 6 Lesson Plan:

Content	**Grade 11 Advance**	
	Chapter 4: Design and customise an IQ CLAWBOT	**Section 3:** Assemble the support arms
		Section 4: Assemble the claw arm and a claw
Time allocated	**Section 3: 1 x 45-minute period**	
	Section 4: 2 x 45-minute periods	
Keywords	**What are the keywords the students must learn?**	
	• Revise the previously learned key terms	
Resources	**What resources are required?** • textbooks • projector • Fusion 360 software	
Prior Knowledge	• Recognise the user interface of Fusion 360.	

Aim:

In this week, students will assemble the support arm, claw arm and a claw for the clawbot. They should follow the instructions to complete the design steps.

Teacher Learning Objectives:

Learning objective refers to what you as a teacher will have taught the student by the end of the lesson. Teachers are to tick the box when they have covered a learning objective.

Student Learning Outcomes: Learning outcomes refer to what the student can expect from the lesson, Teachers must share these outcomes with all students. Teachers are to tick the box when the outcome is achieved. Learning outcomes can be assessed using oral questioning and the written activities.

Teacher should: *(tick as you complete)*	***Students should:*** *(tick as students complete)*
☐ Guide the students on how to assemble the support arms	☐ Insert and assemble the corner connector components.
	☐ Insert and assemble the angled beam components.
	☐ Insert and assemble the beam components.
	☐ Insert and assemble the rubber band anchor components.

☐ Guide the students on how to assemble the claw arm and a claw	☐ Insert and assemble the large gears.
	☐ Assemble the Smart Motor onto the gear shafts.
	☐ Create motion links between the motor and the gears.
	☐ Assemble the left claw arm.

Possible teaching method(s) or approach for this lesson
(teacher to tick the relevant method)

- ☐ Collaborative Teaching (student centred)
- ☐ Instructional / Demonstrative Teaching (teacher centred)
- ☐ Inquiry-based Teaching (student centred)
- ☐ Lecture Style Teaching (teacher centred)
- ☐ Coach Style Teaching (teacher centred)
- ☐ Facilitator Style Teaching (student centred)

Essential and non-essential Sections:

In some lessons it may not be possible to cover every section of the book due to time constraints or lesson variables. Below is a guideline to essential sections for examination and project knowledge.

Topic			Page	
Chapter	**Section**	**Focus**	**Essential**	**Non-essential/Self Study**
CH. 4	**Sec. 3**	Design steps	160-177	
	Sec. 4	Design steps	179-194	

Learning Phases: Section 3 – 1 Period

Phase 1: (Connect) – Starter	Phase 2: Activate	Phase 3: Engage and Demonstrate	Phase 4: Plenary (Consolidate)	Assessment opportunity	Notes for Differentiation
Teacher to introduce students to the lesson aim. Teacher to place all student learning outcomes on the board and ensure student understanding of aims and outcomes of lesson. **Teacher Tip:** When explaining always relate back to everyday examples from their lives. Teacher to set high expectations which inspire, motivate and challenge pupils.	**Task 1:** Teacher to recap on what the students learned last week. **Task 2:** Students are expected to individually assemble the clawbot's support arms following the steps in the book. The teacher should only provide guidance and help when needed. **Task 3:** Teacher to monitor the students' progress throughout the lesson by using the different assessment opportunities. **Teacher tip:** If it's not possible for students to work individually due to lack of resources, divide the students into groups (as small as possible), ask them to work together in the assembly.	Students should complete all steps and paste a picture of their finished assembly as an evidence (activity 4.3.1). **Teacher Tip:** Teacher to demonstrate good subject and curriculum knowledge.	Return to the beginning of the next row	**Questioning**	***Note:*** *All lessons can be different depending on ability and success of previous lesson. Place additional notes or activities to cater for differentiation where necessary throughout the lesson.*

	Teacher to facilitate as peer teaching takes place.				
			Teacher to facilitate as students evaluate learning. Question pupils on what they have learned. Have learning outcomes been met? Has the lesson aim been achieved? All students must complete the official assessment tasks and reflections.	**Oral Assessment** **Student evaluation**	

Important note:

In Step 1a, the first step, page 162, you need to insert only **two** parts from the '228-2500-134' component.

- 228-2500-134 (**two** required)

Learning Phases: Section 4 – 2 Periods

Phase 1: (Connect) – Starter	Phase 2: Activate	Phase 3: Engage and Demonstrate	Phase 4: Plenary (Consolidate) Return to the beginning of the next row	Assessment opportunity	Notes for Differentiation
Teacher to introduce students to the lesson aim. Teacher to place all student learning outcomes on the board and ensure student understanding of aims and outcomes of lesson. **Teacher Tip:** When explaining always relate back to everyday examples from their lives. Teacher to set high expectations which inspire, motivate and challenge pupils.	**Task 1:** Teacher to recap on what the students learned in the previous lesson. **Task 2:** Students are expected to individually assemble the clawbot's claw arm and claw following the steps in the book. The teacher should only provide guidance and help when needed. **Task 3:** Teacher to monitor the students' progress throughout the lesson by using the different assessment opportunities. **Teacher tip:** If it's not possible for students to work individually due to lack of resources, divide the students into groups (as small as possible), ask them to work together in the assembly.	Students should complete all steps and paste a picture of their finished assembly as an evidence (activity 4.4.1). **Teacher Tip:** Teacher to demonstrate good subject and curriculum knowledge.		**Questioning**	***Note:*** *All lessons can be different depending on ability and success of previous lesson. Place additional notes or activities to cater for differentiation where necessary throughout the lesson.*

	Teacher to facilitate as peer teaching takes place.				
			Teacher to facilitate as students evaluate learning. Question pupils on what they have learned. Have learning outcomes been met? Has the lesson aim been achieved? All students must complete the official assessment tasks and reflections.	**Oral Assessment** **Student evaluation**	

Important note:

In Step 1, the first step, page 179, the name of the second part is '228-2500-**215**'

Answer Key

QR code links:		
Page	**Topic**	**Link**
Pg. 160	Finished assembly – Sec 3	https://moeae87206-my.sharepoint.com/:v:/g/personal/fatima_shawish_moe_ae/EUQB4GziIGFPt5-0YI3OReABq6JlcCxF5fiKcXz43yRQeg?e=xis91k
Pg. 179	Finished assembly – Sec 4	https://moeae87206-my.sharepoint.com/:v:/g/personal/fatima_shawish_moe_ae/Ee1Ty349wPVCiSoSt2WQkagBjWBQ3Vcyr0jnfs0psGcwvw?e=8aCWlB

Week 7 Lesson Plan:

Content	**Grade 11 Advance**	
	Chapter 4: Design and customise an IQ CLAWBOT	**Section 5:** Complete the assembly of the VEX IQ robot
		Section 6: Document the robot design
Time allocated	**Section 5: 2 x 45-minute periods**	
	Section 6: 1 x 45-minute period	
Keywords	**What are the keywords the students must learn?**	
	• Revise the previously learned key terms	
Resources	**What resources are required?** • textbooks • projector • Fusion 360 software	
Prior Knowledge	• Recognise the user interface of Fusion 360.	

Aim:

In this week, students will assemble the claws onto the claw arm assembly. Once that is done, they will complete the assembly of the IQ Clawbot and check the claw arm motion. They should follow the instructions to complete the design steps. Then, they will learn how to document their design.

Teacher Learning Objectives:
Learning objective refers to what you as a teacher will have taught the student by the end of the lesson. Teachers are to tick the box when they have covered a learning objective.

Student Learning Outcomes: Learning outcomes refer to what the student can expect from the lesson, Teachers must share these outcomes with all students. Teachers are to tick the box when the outcome is achieved. Learning outcomes can be assessed using oral questioning and the written activities.

Teacher should: *(tick as you complete)*	***Students should:*** *(tick as students complete)*
☐ Guide the students on how to complete the assembly of the VEX IQ robot.	☐ Insert and assemble the claws onto the assembly.
	☐ Create motion links to animate the claws.
	☐ Insert the claw arm assembly into the supplied IQ robot assembly design.

	☐ Assemble the claw arm to the robot then review the motion of the claw arm assembly.
☐ Explain how to use the 'Drawing' workspace to document the design.	☐ Create a new drawing from the existing IQ Clawbot robot design.
	☐ Document the robot design by creating drawings of the complete assembly.

Possible teaching method(s) or approach for this lesson

(teacher to tick the relevant method)

- ☐ Collaborative Teaching (student centred)
- ☐ Instructional / Demonstrative Teaching (teacher centred)
- ☐ Inquiry-based Teaching (student centred)
- ☐ Lecture Style Teaching (teacher centred)
- ☐ Coach Style Teaching (teacher centred)
- ☐ Facilitator Style Teaching (student centred)

Essential and non-essential Sections:

In some lessons it may not be possible to cover every section of the book due to time constraints or lesson variables. Below is a guideline to essential sections for examination and project knowledge.

Topic			Page	
Chapter	**Section**	**Focus**	**Essential**	**Non-essential/Self Study**
CH. 4	**Sec. 5**	Design steps	196-212	
	Sec. 6	Documentation steps	214-221	

Learning Phases: Section 5 – 2 Periods

Phase 1: (Connect) – Starter	Phase 2: Activate	Phase 3: Engage and Demonstrate	Phase 4: Plenary (Consolidate) Return to the beginning of the next row	Assessment opportunity	Notes for Differentiation
Teacher to introduce students to the lesson aim. Teacher to place all student learning outcomes on the board and ensure student understanding of aims and outcomes of lesson. **Teacher Tip:** When explaining always relate back to everyday examples from their lives. Teacher to set high expectations which inspire, motivate and challenge pupils.	**Task 1:** Teacher to recap on what the students learned last week. **Task 2:** Students are expected to individually complete the assembly of the VEX IQ robot following the steps in the book. The teacher should only provide guidance and help when needed. **Task 3:** Teacher to monitor the students' progress throughout the lesson by using the different assessment opportunities. **Teacher tip:** If it's not possible for students to work individually due to lack of resources, divide the students into groups (as small as possible), ask them	Students should complete all steps and paste a picture of their finished assembly as an evidence (activity 4.5.1). **Teacher Tip:** Teacher to demonstrate good subject and curriculum knowledge.		**Questioning**	***Note:*** *All lessons can be different depending on ability and success of previous lesson. Place additional notes or activities to cater for differentiation where necessary throughout the lesson.*

	to work together in the assembly. *Teacher to facilitate as peer teaching takes place.*				
			Teacher to facilitate as students evaluate learning. Question pupils on what they have learned. Have learning outcomes been met? Has the lesson aim been achieved? All students must complete the official assessment tasks and reflections.	**Oral Assessment** **Student evaluation**	

Important note:

In Step 1a, the third step, page 199, if setting the offset value to (-1) didn't fix the overlapping with the gear mechanism, change the z-offset to (1).

In Step 2b, the forth step, page 204, in the browser menu you need to right-click the 'CLAW ARM RIGHT' and not the '36T LEFT'.

Learning Phases: Section 6 – 1 Period

Phase 1: (Connect) – Starter	Phase 2: Activate	Phase 3: Engage and Demonstrate	Phase 4: Plenary (Consolidate) Return to the beginning of the next row	Assessment opportunity	Notes for Differentiation
Teacher to introduce students to the lesson aim. Teacher to place all student learning outcomes on the board and ensure student understanding of aims and outcomes of lesson. **Teacher Tip:** When explaining always relate back to everyday examples from their lives. Teacher to set high expectations which inspire, motivate and challenge pupils.	**Task 1:** Teacher to recap on what the students learned last week. **Task 2:** Students are expected to individually follow the steps in the book to document their design. The teacher should only provide guidance and help when needed. **Task 3:** Teacher to monitor the students' progress throughout the lesson by using the different assessment opportunities. **Teacher tip:** If it's not possible for students to work individually due to lack of resources, divide the students into groups (as small as possible), ask them to work together in the assembly.	Students should complete all steps and paste a picture of their finished assembly as an evidence (activity 4.6.1). **Teacher Tip:** Teacher to demonstrate good subject and curriculum knowledge.		**Questioning**	***Note:*** *All lessons can be different depending on ability and success of previous lesson. Place additional notes or activities to cater for differentiation where necessary throughout the lesson.*

	Teacher to facilitate as peer teaching takes place.				
			Teacher to facilitate as students evaluate learning. Question pupils on what they have learned. Have learning outcomes been met? Has the lesson aim been achieved? All students must complete the official assessment tasks and reflections.	**Oral Assessment** **Student evaluation**	

Answer Key

QR code links:		
Page	**Topic**	**Link**
Pg. 195	Finished assembly – Sec 5	https://moeae87206-my.sharepoint.com/:v:/g/personal/fatima_shawish_moe_ae/EUUP5GhQSOxLmxERsOicerYB-26p6hHNCp7ql4SVxFIm0g?e=TSsI01
Pg. 213	Finished assembly – Sec 6	https://moeae87206-my.sharepoint.com/:v:/g/personal/fatima_shawish_moe_ae/EUMrYgVnhzpOmTR08sv9DfYBijNyNQT94m2NqacsRSrJZA?e=xQdeBA

Week 8 Lesson Plan:

Content	**Grade 11 Advance**	
	Chapter 4: Design and customise an IQ CLAWBOT	**Section 7:** Rendering and animation
Time allocated	**3 x 45-minute periods**	
Keywords	**What are the keywords the students must learn?**	
	• Render	
Resources	**What resources are required?** • textbooks • projector • Fusion 360 software	
Prior Knowledge	• Recognise the user interface of Fusion 360.	

Aim:

In this week, students will you will create photorealistic images of the robot in the Render workspace. They will also learn how to control over the scene settings, where they will be able to control the environment or the lighting of the scene. Students will also learn how to create animations of exploded views in the Animation workspace. These animations can be published and shared.

Teacher Learning Objectives:

Learning objective refers to what you as a teacher will have taught the student by the end of the lesson. Teachers are to tick the box when they have covered a learning objective.

Student Learning Outcomes: Learning outcomes refer to what the student can expect from the lesson, Teachers must share these outcomes with all students. Teachers are to tick the box when the outcome is achieved. Learning outcomes can be assessed using oral questioning and the written activities.

Teacher should: *(tick as you complete)*	***Students should:*** *(tick as students complete)*
☐ Guide the students on how to navigate the render workspace.	☐ Change the appearance of components on the robot assembly.
	☐ Set the environment and lighting for the scene.

	☐ Render the scene using the cloud and local options.
☐ Guide the students on how to navigate the animation workspace.	☐ Create an exploded view of the VEX IQ Smart Motor.
	☐ Publish the animation.

Possible teaching method(s) or approach for this lesson
(teacher to tick the relevant method)

- ☐ Collaborative Teaching (student centred)
- ☐ Instructional / Demonstrative Teaching (teacher centred)
- ☐ Inquiry-based Teaching (student centred)
- ☐ Lecture Style Teaching (teacher centred)
- ☐ Coach Style Teaching (teacher centred)
- ☐ Facilitator Style Teaching (student centred)

Essential and non-essential Sections:

In some lessons it may not be possible to cover every section of the book due to time constraints or lesson variables. Below is a guideline to essential sections for examination and project knowledge.

Topic			Page	
Chapter	**Section**	**Focus**	**Essential**	**Non-essential/Self Study**
CH. 4	**Sec. 7**	Design steps	223-239	

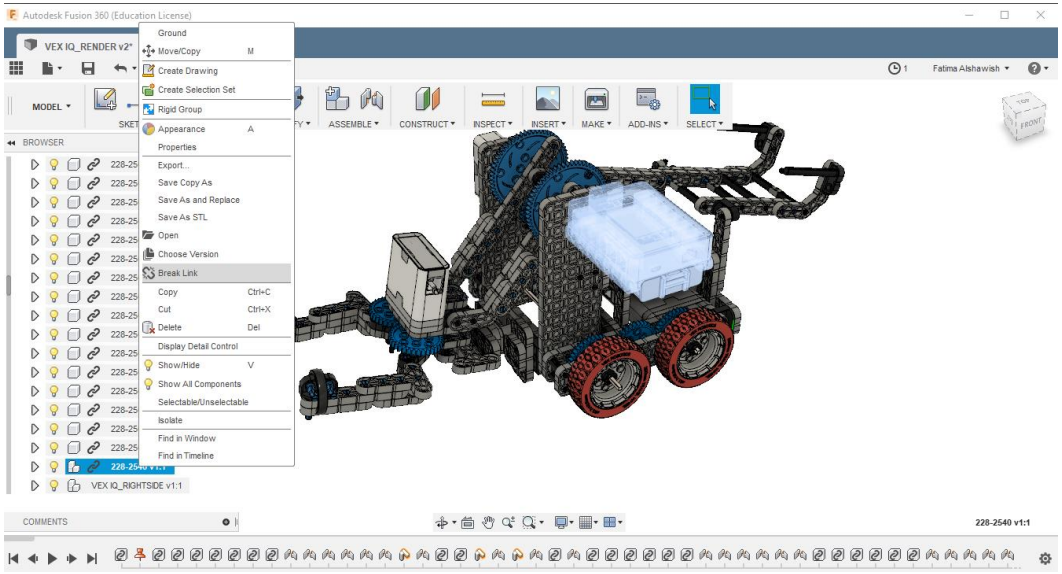
Learning Phases: Section 7 – 3 Periods

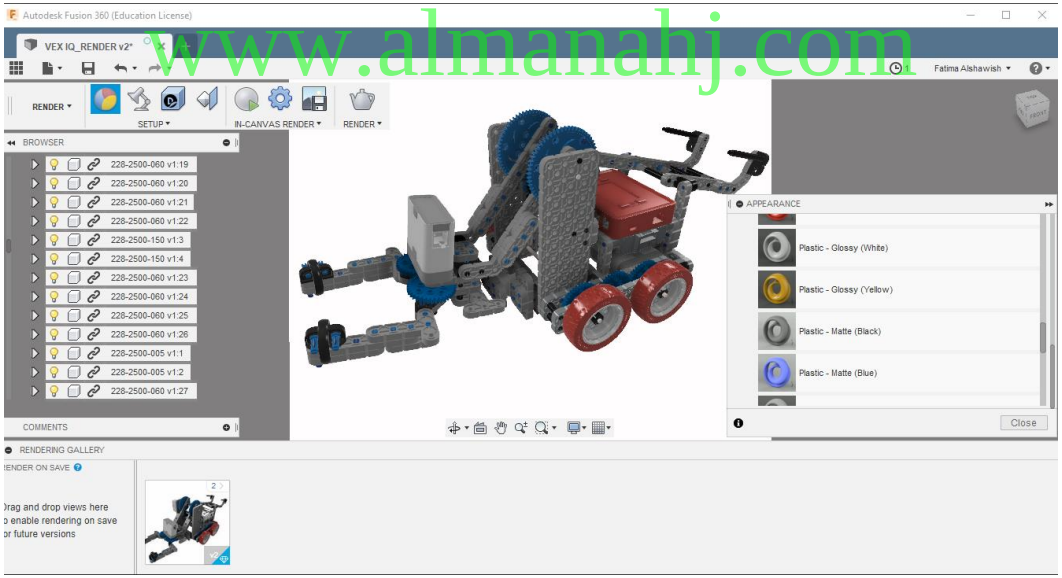
Phase 1: (Connect) – Starter	Phase 2: Activate	Phase 3: Engage and Demonstrate	Phase 4: Plenary (Consolidate) Return to the beginning of the next row	Assessment opportunity	Notes for Differentiation
Teacher to introduce students to the lesson aim. Teacher to place all student learning outcomes on the board and ensure student understanding of aims and outcomes of lesson. **Teacher Tip:** When explaining always relate back to everyday examples from their lives. Teacher to set high expectations which inspire, motivate and challenge pupils.	**Task 1:** Teacher to recap on what the students learned last week. **Task 2:** Students are expected to individually change the appearance and scene setting of their robot design following the steps in the book. The teacher should only provide guidance and help when needed. **Task 3:** Students are expected to individually create an animation of the motor assembly following the steps in the book. The teacher should only provide guidance and help when needed. **Task 4:** Teacher to monitor the students' progress throughout the lesson by	Students should complete all steps and paste a picture of their finished assembly as an evidence (activity 4.7.1). **Teacher Tip:** Teacher to demonstrate good subject and curriculum knowledge.		**Questioning**	***Note:*** *All lessons can be different depending on ability and success of previous lesson. Place additional notes or activities to cater for differentiation where necessary throughout the lesson.*

	using the different assessment opportunities. **<u>Teacher tip:</u>** If it's not possible for students to work individually due to lack of resources, divide the students into groups (as small as possible), ask them to work together in the assembly. *Teacher to facilitate as peer teaching takes place.*				
			Teacher to facilitate as students evaluate learning. Question pupils on what they have learned. Have learning outcomes been met? Has the lesson aim been achieved? All students must complete the official assessment tasks and reflections.	**Oral Assessment** **Student evaluation**	

Important note:

When rendering, if students wish to change the color of different parts of the design other than the wheels a warning message will appear, and part won't change its color. That is because in Fusion you can apply an appearance either to a body, a component, or to individual faces. In our assembly it was applied to a body. Body appearance is not an overridable attribute in a top-level assembly. Component appearance can be overridden. To fix this: go to model workspace, right-click on the part that you want to recolor and click break links. Then, you should be able to change the color in the top-level assembly without this error. An example is shown on the next page.
(In the Fusion file provided for this section, the wheels links were already broken)





Answer Key

QR code links:		
Page	**Topic**	**Link**
Pg. 223	Finished assembly – Sec 7	https://moeae87206-my.sharepoint.com/:v:/g/personal/fatima_shawish_moe_ae/EWzMM8pByHVEqr1O2ESlUuIBeZ-bdXxI-Zpl67bs8OVeTA?e=AOO3d4

Week 9 Lesson Plan:

Content	**Grade 11 Advance**	
	Chapter 4: Design and customise an IQ CLAWBOT	**Section 8:** Design a custom robot part
Time allocated 	**3 x 45-minute periods**	
Keywords 	**What are the keywords the students must learn?**	
	• Revise the previously learned key terms	
Resources 	**What resources are required?** • textbooks • projector • Fusion 360 software	
Prior Knowledge 	• Recognise the user interface of Fusion 360.	

Aim:

In this week, students will you will learn how to design a holder for a cell phone that can be attached to the robot.

Teacher Learning Objectives:

Learning objective refers to what you as a teacher will have taught the student by the end of the lesson. Teachers are to tick the box when they have covered a learning objective.

Student Learning Outcomes: Learning outcomes refer to what the student can expect from the lesson, Teachers must share these outcomes with all students. Teachers are to tick the box when the outcome is achieved. Learning outcomes can be assessed using oral questioning and the written activities.

Teacher should: *(tick as you complete)*	***Students should:*** *(tick as students complete)*
☐ Guide the students on how to model a custom part.	☐ Design a cell phone holder.
	☐ Assemble the cell phone holder onto the IQ robot.

Possible teaching method(s) or approach for this lesson

(teacher to tick the relevant method)

- Collaborative Teaching (student centred)
- Instructional / Demonstrative Teaching (teacher centred)
- Inquiry-based Teaching (student centred)
- Lecture Style Teaching (teacher centred)
- Coach Style Teaching (teacher centred)
- Facilitator Style Teaching (student centred)

Essential and non-essential Sections:

In some lessons it may not be possible to cover every section of the book due to time constraints or lesson variables. Below is a guideline to essential sections for examination and project knowledge.

Topic			Page	
Chapter	**Section**	**Focus**	**Essential**	**Non-essential/Self Study**
CH. 4	**Sec. 8**	Design steps	241-264	

Learning Phases: Section 8 – 3 Periods

Phase 1: (Connect) – Starter	Phase 2: Activate	Phase 3: Engage and Demonstrate	Phase 4: Plenary (Consolidate) Return to the beginning of the next row	Assessment opportunity	Notes for Differentiation
Teacher to introduce students to the lesson aim. Teacher to place all student learning outcomes on the board and ensure student understanding of aims and outcomes of lesson. **Teacher Tip:** When explaining always relate back to everyday examples from their lives. Teacher to set high expectations which inspire, motivate and challenge pupils.	**Task 1:** Teacher to recap on what the students learned last week. **Task 2:** Students are expected to individually model the cell phone holder following the steps in the book. The teacher should only provide guidance and help when needed. **Task 3:** Students are expected to individually assemble the cell phone holder onto their robot design following the steps in the book. The teacher should only provide guidance and help when needed. **Task 4:** Teacher to monitor the students' progress throughout the lesson by using the different assessment opportunities.	Students should complete all steps and paste a picture of their finished assembly as an evidence (activity 4.8.1). **Teacher Tip:** Teacher to demonstrate good subject and curriculum knowledge.		**Questioning**	***Note:*** *All lessons can be different depending on ability and success of previous lesson. Place additional notes or activities to cater for differentiation where necessary throughout the lesson.*

	Teacher tip: If it's not possible for students to work individually due to lack of resources, divide the students into groups (as small as possible), ask them to work together in the assembly. *Teacher to facilitate as peer teaching takes place.*				
			Teacher to facilitate as students evaluate learning. Question pupils on what they have learned. Have learning outcomes been met? Has the lesson aim been achieved? All students must complete the official assessment tasks and reflections.	**Oral Assessment** **Student evaluation**	

Answer Key

QR code links:		
Page	**Topic**	**Link**
Pg. 241	Finished assembly – Sec 8	https://moeae87206-my.sharepoint.com/:v:/g/personal/fatima_shawish_moe_ae/EV3R0NSpul1MgT9hbt-tgiYBsIGTGccucdS9wBL0DhGUWA?e=kaimbs
		https://moeae87206-my.sharepoint.com/:v:/g/personal/fatima_shawish_moe_ae/ETGijlDLWUVKp4RcwNFk6dABwwF-8U53iMqW6Q4tEPx9Rg?e=1tJNT1

Week 11 Lesson Plan:

Content	**Grade 11 Advance**	
	Chapter 2: Innovative and creative robot design	**Section 2:** Design process
Time allocated	**1 x 45-minute periods**	
Keywords	**What are the keywords the students must learn?**	
	• Revise the previously learned key terms	
Resources	**What resources are required?** • textbooks • projector • Fusion 360 software	
Prior Knowledge	• Recognise the user interface of Fusion 360.	

Aim:

In this week, students will go back to the design process and complete stages 5 and 6.

Teacher Learning Objectives:

Learning objective refers to what you as a teacher will have taught the student by the end of the lesson. Teachers are to tick the box when they have covered a learning objective.

Student Learning Outcomes: Learning outcomes refer to what the student can expect from the lesson, Teachers must share these outcomes with all students. Teachers are to tick the box when the outcome is achieved. Learning outcomes can be assessed using oral questioning and the written activities.

Teacher should: *(tick as you complete)*	***Students should:*** *(tick as students complete)*
☐ Recap on the stages of the design process.	☐ Paste a picture of their complete work.
	☐ Evaluate their design.

Possible teaching method(s) or approach for this lesson

(teacher to tick the relevant method)

- Collaborative Teaching (student centred)
- Instructional / Demonstrative Teaching (teacher centred)
- Inquiry-based Teaching (student centred)
- Lecture Style Teaching (teacher centred)
- Coach Style Teaching (teacher centred)
- Facilitator Style Teaching (student centred)

Essential and non-essential Sections:

In some lessons it may not be possible to cover every section of the book due to time constraints or lesson variables. Below is a guideline to essential sections for examination and project knowledge.

Topic			Page	
Chapter	**Section**	**Focus**	**Essential**	**Non-essential/Self Study**
CH. 2	**Sec. 2**	Design process	65-68	

Learning Phases:

Phase 1: (Connect) – Starter	Phase 2: Activate	Phase 3: Engage and Demonstrate	Phase 4: Plenary (Consolidate) Return to the beginning of the next row	Assessment opportunity	Notes for Differentiation
Teacher to introduce students to the lesson aim. Teacher to place all student learning outcomes on the board and ensure student understanding of aims and outcomes of lesson. **Teacher Tip:** When explaining always relate back to everyday examples from their lives. Teacher to set high expectations which inspire, motivate and challenge pupils.	**Task 1:** Teacher to recap on the stages of the design process.	**Task 1:** Students should complete the design evaluation individually. **Task 2:** Ask students to find a partner and ask them to give feedback on each other's work. **Teacher Tip:** Teacher to demonstrate good subject and curriculum knowledge.		**Questioning**	***Note:*** *All lessons can be different depending on ability and success of previous lesson. Place additional notes or activities to cater for differentiation where necessary throughout the lesson.*
			Teacher to facilitate as students evaluate learning. Question pupils on what they have learned. Have learning outcomes been met? Has the lesson aim been achieved? All students must complete the official assessment tasks and reflections.	**Oral Assessment** **Student evaluation**	

Answer Key

Stage 6: Evaluation

Why is evaluation important?

It might be useful to discuss with students why evaluation and self-reflection is an important final stage of their project.

Evaluation affords the opportunity to reflect on the completed project. What went well and what could be improved in the future or what could I do better. It is a worthy learning process for overall improvement of our students in the subject of CDI.

What guidance can I give my students in completing the evaluation?

- Break down the evaluation questions and ensure student understanding of what is being asked.
- Facilitate as student's complete evaluation and submit.
- Encourage students not to just concentrate on the negatives but to really think about the positives, what went well and what are they most proud of.
- Facilitate students as they complete the student reflection section and point out the importance of reflection in all projects they complete.