

**SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY**

**SAULT STE. MARIE, ONTARIO**



Sault College

**CICE COURSE OUTLINE**

**COURSE TITLE:** Heavy Equipment II Theory

**CODE NO. :** HED111 **SEMESTER:** Winter  
**MODIFIED CODE:** HED011

**PROGRAM:** Truck & Coach/Heavy Duty Equipment Technician

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**MODIFIED BY:** Rachel Valois – Learning Specialist – CICE Program

**DATE:** Jan 2009 **PREVIOUS OUTLINE DATED:** Jan 2008

**APPROVED:** “Angelique Lemay”

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	<b>CHAIR, COMMUNITY SERVICES</b>	<b>DATE</b>
<b>TOTAL CREDITS:</b>	10	

**PREREQUISITE(S):** HED101/HED0101

**HOURS/WEEK:** 8 Hours

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*School of Health and Community Services*  
*(705) 759-2554, Ext. 2603*

**I. COURSE DESCRIPTION:**

HED111/HED011 will compliment diesel engine theory taken in the first semester, as well as add cylinder head reconditioning, cooling and lubrication systems, exhaust, turbocharging and aftercooling, air induction systems, as well as the various drive train components encountered in heavy duty and truck / coach power trains. Truck and trailer coupling devices will be studied as well. Safety elements of the repair industry will be stressed. Skills learned in this semester can be applied to the construction, material handling, mining, forestry, equipment rental, and transportation industries.

**II. LEARNING OUTCOMES AND ELEMENTS OF THE PERFORMANCE:**

Upon successful completion of this course, the CICE student, along with the assistance of a Learning Specialist, will demonstrate the basic ability to:

1. Inspect, analyze and understand the repair procedures for engine cylinder head components, and valve trains.

Potential Elements of the Performance:

- Recommend proper valve grinding techniques
  - Recognize valve guide replacement or reconditioning methods
  - Identify the correct valve seat grinding or cutting angles and proper machining sequence to ensure optimum valve performance.
2. Recognize the various engine lubrication components and understand their operating principles and maintenance requirements.

Potential Elements of the Performance:

- Identify lube pump type and operating fundamentals.
  - Recognize the where and why of safety valves, pressure regulating valves, by-pass valves, and priority circuits.
  - Identify and understand the maintenance procedures for full-flow and partial flow filters, and centrifugal devices.
  - Identify the various types and location of oil coolers.
  - Recognize lubrication API and SAE ratings and their purpose.
3. Support the heavy equipment and truck maintenance industries by recognizing components and identifying the correct cooling system analysis, maintenance and preventive maintenance procedures.

Potential Elements of the Performance:

- Recognize radiators, rad caps, water pumps, seals, heat exchangers, thermostatic controls, fans, fan drives, and shutters, and the proper diagnostics and maintenance, repair or replacement of those components.
  - Ensure air cooled engine and heat exchanger systems are in working order and maintained.
4. Evaluate and maintain the various air induction and exhaust systems

in the heavy equipment and truck industries.

Potential Elements of the Performance:

- Identify inspect and maintain air pre-cleaners, single and multi-stage air filters, mechanical blowers, turbochargers and after coolers.
  - Measure and assess air restriction, exhaust back pressure and crankcase blow-by accurately and safely.
5. Measure engine horsepower and torque on a dynamometer and be able to calculate fuel consumption under various load full throttle conditions.

Potential Elements of the Performance:

- Ensure safe start-up and operation of a water brake dynamometer.
  - Interpret BSFC performance graph data for full or part load fuel consumption.
6. Diagnose and recommend repair and maintenance procedures for heavy equipment and truck related drive train components.

Potential Elements of the Performance:

- Identify and understand the operating fundamentals and adjustment and repair/replacement procedures for push release, pull release and over centered clutches.
- Calculate simple and compound gear train speed outcomes and ratio.
- Recognize the various gear set advantages, and special lubricants and maintenance procedures.
- Follow power flows through single and multi-countershaft manual transmissions, recognize shifter mechanisms and safety devices such as detents and interlocks.
- Recognize torque convertor construction and operation.
- Follow torque flow through countershaft and planetary powershift transmissions.
- Identify various universal joints, their construction and operation, phasing and angle requirements.
- Recognize construction and purpose and operating principles of single and double reduction differentials, interaxle differentials, limited slip, differential locks and torque proportioning differentials.
- Identify and understand reduction final drives including planetary, pinion-bull gear, and chain type.

7. Support the truck transportation maintenance and repair industry by identifying and recommending the proper replacement / repair / or maintenance of coupling pintle and fifth wheel assemblies.

Potential Elements of the Performance:

- Identify and understand the operating principles of fifth wheel and pintle hook coupling devices, their inherent wear points and the accurate testing and assessment of these vital components.

### III. TOPICS:

1. Engine Cylinder Heads and Valve Trains
2. Engine Lubrication Systems
  - Lubricants
3. Engine Cooling Systems
  - Air
  - Liquid
4. Engine Air Induction and Exhaust Systems
5. Engine Performance
  - Torque
  - Horsepower
  - BSFC
6. Drive Trains
  - Clutches
  - Gears
  - Manual Transmissions
  - Drive Lines
  - Differentials
  - Final Drives
7. Coupling Devices
  - Fifth Wheel Construction and Operation

### IV. REQUIRED RESOURCES/TEXTS/MATERIALS:

Heavy Duty Truck Systems 4th Edition (Thomson Delmar)  
Diesel Technology (Nelson Thompson)  
Diesel Technology Workbook  
Vickers Mobile Hydraulics Manual  
Power Trains (John Deere)  
Pens, pencils, coloured pencils, calculator, and 3-ring binder

## V. EVALUATION PROCESS/GRADING SYSTEM:

The Truck and Coach / Heavy Duty Equipment Technician program considers both HED 111 Theory and HED 110 Shop to be co-requisites. Students must successfully complete both courses in the same semester.

Theory letter grades are based on;

- 70% of semester theory exam average
- 20% of semester theory assignment average
- 10% of assessed employability skills ( attendance, punctuality, work ethics, and attitude )

The following semester grades will be assigned to students:

<u>Grade</u>	<u>Definition</u>	<u>Grade Point Equivalent</u>
A+	90 – 100%	4.00
A	80 – 89%	
B	70 - 79%	3.00
C	60 - 69%	2.00
D	50 – 59%	1.00
F (Fail)	49% and below	0.00
CR (Credit)	Credit for diploma requirements has been awarded.	
S	Satisfactory achievement in field /clinical placement or non-graded subject area.	
U	Unsatisfactory achievement in field/clinical placement or non-graded subject area.	
X	A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.	
NR	Grade not reported to Registrar's office.	
W	Student has withdrawn from the course without academic penalty.	

## VI. SPECIAL NOTES:

### Disability Services:

If you are a student with a disability (e.g. physical limitations, visual impairments, hearing impairments, or learning disabilities), you are encouraged to discuss required accommodations with your professor and/or the Disability Services office. Visit Room E1101 or call Extension 2703 so that support services can be arranged for you.

Retention of Course Outlines:

It is the responsibility of the student to retain all course outlines for possible future use in acquiring advanced standing at other postsecondary institutions.

Communication:

The College considers **WebCT/LMS** as the primary channel of communication for each course. Regularly checking this software platform is critical as it will keep you directly connected with faculty and current course information. Success in this course may be directly related to your willingness to take advantage of the **Learning Management System** communication tool.

Plagiarism:

Students should refer to the definition of “academic dishonesty” in *Student Code of Conduct*. Students who engage in academic dishonesty will receive an automatic failure for that submission and/or such other penalty, up to and including expulsion from the course/program, as may be decided by the professor/dean. In order to protect students from inadvertent plagiarism, to protect the copyright of the material referenced, and to credit the author of the material, it is the policy of the department to employ a documentation format for referencing source material.

Course Outline Amendments:

The professor reserves the right to change the information contained in this course outline depending on the needs of the learner and the availability of resources.

Substitute course information is available in the Registrar's office.

## **Class and Shop Conduct – Motive Power Policies and Procedures**

The Heavy Equipment Program considers both HED210-11 Theory and HED211-9 Shop to be co-requisites. Students must successfully complete both courses in the same semester.



### **Motive Power Department Truck/Coach-Heavy Equipment Department Policies and Procedures Policy Information Sheet**

1. During your program, you are considered to be a member of the Motive Power Department. As such, your actions and department, both in the college and the community reflect on this Department. We trust that your influence will be positive.
2. College policy prohibits the consumption of food and drink in the classrooms and shop. Smoking is allowed only outside of the building in designated smoking areas. **No smokeless tobacco is allowed in theory class or shop class.**
3. CSA approved Safety Glasses and Safety Boots must be worn in the Shop at all times. This means going to and from all of the classrooms located in the shop. It is the responsibility of the **STUDENT** to wear them. You will be marked absent if the aforementioned policy is not adhered to.

**Note: All safety glasses and boots must meet Sault College CSA approval rating.**

See attachment RE: **Eye, Face and Foot Personal Protection Equipment (PPE)**

### **NO GLASSES-NO BOOTS-NO ENTRY!!**

4. Repairs to your private vehicles in our facilities can be educational to you. We will accommodate you if the work is part of our program and schedules in. **No car should be parked in the shop compound without staff permission and a temporary parking pass clearly displayed.**
5. **Attendance** – if late, don't bother coming until the next class, you will be marked absent. The student is to be continuously present and actively participating during all scheduled theory and shop classes (scheduled breaks excepted). For every unexcused absence you will be deducted 1% per class period missed from that specific unit for the time missed.
6. The student must have safety boots and safety glasses readily available because you may not have a lot of warning when going into shop.

- 7.** Please, coffee breaks only 10 to 12 minutes **MAXIMUM. NOTE: Individual Professors will address each class with their expectations. Some may only allow 10 minutes.**
- 8.** Please refrain from loitering in “C” wing hallways, around shop hallway entry doors and outside entrance doorways/walkways.
- 9.** Drinking alcohol at lunch is discouraged and students will be excused from class at the Professor’s discretion.
- 10.** Welding attendance is **MANDATORY, as are all related subjects.** It is in your best interests to attend all classes on your schedule. Remember, you need to successfully complete all assigned courses to graduate.
- 11.** If you miss a test with an “**unexcused absence**” (as deemed legitimate by your professor) you will **NOT** be allowed to write that test. Only if; a doctors note, airline ticket, etc., or circumstances arising from a family emergency; and legitimate written proof can be presented to the professor. See item number 16 below for clarification.
- 12.** If a class is missed or going to be missed it is your responsibility to notify in writing (see item #16 below) your Professor and make arrangements for handouts and notes taken while you are away.
- 13.** The use of cell phones/PDA’s, electronic information/image capturing or recording device for any form of communication or recording (voice, text, recording, image, etc...) during theory class or shop is strictly prohibited. Cell phones/PDA’s must be silenced during regular class and shop times and must be turned off and kept out of sight during test sittings. Failure to follow the latter requirement during a test sitting will result in a grade of 0 (zero) being assigned. **NO EXCEPTIONS.**
- 14.** Students may not wear earphones/headphones of any kind (i.e. for playback of recorded music/voice) during theory classes, shop classes and test sittings. This does not include hearing aids as required by hearing impaired students.
- 15.** **NO Lap Top Computers** will be allowed in any class unless proper documentation is provided that the computer is required for learning assistance.



- 16.** Any request to deviate from the aforementioned course outline requirements must be made to the Professor in writing or via Sault College email. If permission is granted it must also be granted in writing or via Sault College email. Verbal requests/permissions are not acceptable. It is the students responsibility to maintain a copy of all such requests and associated permissions.

**Student Signature:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Students refusing to sign this form will not be allowed to register or continue in their course.**

# Guideline For Truck/Coach-Heavy Equipment

## 1. **ATTENDANCE**

A terminal objective of the Motive Power Department is the demonstration of satisfactory attendance and punctuality performance that the Motive Power Industry, itself, relies on, for efficiency, productivity and profitability.

- Absences will affect your learning and your final grade.

- 1.1 Students are encouraged to be present for the full duration of each class. Shop attendance is recorded at the start and end of class. Students are expected to be continuously present and actively participating (scheduled breaks excepted) for the entire class.
- 1.2 If you are absent from class at the time of attendance, you will be marked absent from the entire class.
- 1.3 If you are marked absent, and no reasonable excuse is given your absence will be termed unexcused. There should **NOT** be a reason to **NOT** let us know nor related subject Professors, in writing why you're absent.
- 1.4 Students will lose marks from their theory and shop mark grade for unexcused absences. Poor attendance can mean a repeat of both theory and shop courses if your employment skills are poor. This is based on the 10% Employability Skills.
- 1.5 At 10% of accumulated hours of unexcused absence you will be asked to a scheduled meeting with your Professor and will be asked to sign a contract enabling you to continue the course.
- 1.6 If you are absent from class, the lesson material is your responsibility.

## 2. **BEHAVIOR/ATTITUDE**

- 2.1 Students are required to:
  - a) Properly care for and maintain all shop and classroom equipment.
  - b) Properly clean the shop/classroom facility and equipment at the end of each class.
  - c) Remain in the class during clean-up and assist in the cleaning and shutting down of their shop/classroom.
- 2.2 Students are expected to conduct themselves in a manner that does not interfere with or obstruct the overall learning environment.

- 2.3 The following activities are not allowed in the shop/classrooms:
- Horseplay.
  - Making unnecessary noise.
  - Swearing.
  - Abusive behavior.
  - Smoking, chewing smokeless tobacco, beverages and eating.

### 3. ASSIGNMENTS AND THEORY TESTS

- 3.1 Students are required to hand in assignments or write theory tests on the day and at the time specified/scheduled. See item #16 in the aforementioned document. You must attend 90% of the classes in a unit to be eligible to write the unit test.
- 3.2 Assignments will be graded as follows:
- One day after the original due date – 70% maximum.
  - Two or more days after the original due date – 50% maximum.

**NOTE:** The only exception of guideline 3 shall be those arising from personal emergencies (i.e. car accident, family death, serious illness, employment reasons) and the student supplies a written statement to that effect. See item #16 in the aforementioned document.

### 4. SAFETY

- 4.1 Students are required to wear their personal protective equipment (i.e. C.S.A approved safety boots and impact safety glasses) at all times while in the shop area. See attached addendum at the end of this document.
- 4.2 Students must not enter the shop area or commence work before their scheduled time.
- 4.3 Students must not work alone or in an unsupervised area.
- 4.4 Students must have lift truck training prior to operating those units.
- 4.5 Students must have equipment training and Technologist/Professor approval before operating any equipment.
- 4.6 Students must not use or operate equipment that is found to be unsafe or damaged. All such equipment must be reported to the Professor or Technologist who will replace and/or repair the said equipment.
- 4.7 Where damaged or unsafe equipment cannot be repaired or replaced, the Professor/Technologist will provide students alternate shop activity.
- 4.8 Students must follow instructions and safe work practices in order to use or operate any shop equipment.



## Student Assessment Procedure For Truck/Coach-Heavy Equipment THEORY

Theory assessment is based on regularly scheduled tests and assignments. Attendance and home work checks are recorded and used as an aid for counseling. The following grades will be assigned:

A+	90 to 100 (Numerical Equivalent 4.00)	- Consistently Outstanding.
A	80 to 89 (Numerical Equivalent 4.00)	- Outstanding Achievement
B	70 to 79 (Numerical Equivalent 3.00)	- Consistently Above Average Achievement.
C	60 to 69 (Numerical Equivalent 2.00)	- Satisfactory or Acceptable Achievement.
D	50 to 59. (Numerical Equivalent 1.00)	- Acceptable when other marks average to a passing grade.
F (Fail)	49% and below.(Numerical equivalent 0:00) – unacceptable performance.	
CR – (Credit)	Credit for diploma requirements has been awarded.	
U -	Unsatisfactory achievement in field/clinical placement or non-graded subject area.	
X –	A temporary grade, limited to situations with extenuating circumstances, giving a student additional time to complete the requirements for a course.	
NR –	Grade not reported to the Registrars office.	
W –	Student has withdrawn from the course without academic penalty.	

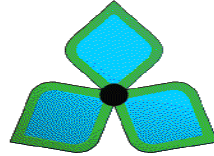
Your **Semester Theory Letter Grade** will be comprised of:

- 70% of Semester Theory Exam Average.
- 20% of Semester Theory Assignment Average.
- 10% of Assessed and Employability Skills (attendance, punctuality, attitude and work ethics)

A **60% Average of the total semester exam and assignments** must be achieved to receive a passing grade in Theory.

A student **cannot rewrite** a test to improve his/her mark.

If a test is missed by a student, without a good reason, an **“Incomplete”** grade is allotted.



## Student Assessment Procedure For Truck/Coach-Heavy Equipment SHOP

Shop assessment is based on two criteria:

1. 70% on project or shop assignments and on the students' ability as measured subjectively by performance on a variety of shop tasks. Such assignments or projects not received on time will be degraded accordingly.
2. 30% on employability skills. Attendance, punctuality, preparedness (safety boots, glasses, coveralls on and ready to work), house keeping, work organization and general attitude.

The following grades will be assigned:

A+	90 – 100% (Numerical Equivalent 4.00)	- Consistently Outstanding.
A	80 – 89% (Numerical Equivalent 4.00)	- Outstanding Achievement.
B	70 – 79% (Numerical Equivalent 3.00)	- Consistently Above Average Achievement.
C	60 – 69% (Numerical Equivalent 2.00)	- Satisfactory or Acceptable Achievement.
D	50 – 59% (Numerical Equivalent 1.00)	- Acceptable when other marks average to a passing grade.
F (Fail)	49% or below (Numerical Equivalent 0.00)	- Repeat – Objectives of course not achieved and course must be repeated.

CR (Credit) Credit for diploma requirements has been awarded.

S – Satisfactory achievement in field/clinical placement or non-graded subject area.

U – Unsatisfactory achievement in field/clinical placement or non-graded subject area.

X - A temporary grade, limited to situations with extenuating circumstances, giving a student additional time to complete the requirements for a course.

NR – Grade not reported to the Registrars office.

W – Student has withdrawn from the course without academic penalty.



## **Eye, Face and Foot Personal Protection Equipment (PPE)**

Students are required to wear appropriate Personal Protection Equipment (PPE) in designated areas at all times. The designated areas for eye and foot protection in the Motive Power areas are: C1073 (Automotive), C1000, C1010, and C1040 (Truck/Coach and Heavy Equipment) and C1120 (Marine and Small Engines). Appropriate PPE must also be worn when facing hazards outside of these designated areas.

### **Eye Protection:**

**All protective eye wear shall meet the requirements of:**

**C.S.A. - Z94.3 or A.N.S.I. - Z87.1 +.**

**Approved safety glasses (lens and frames) shall have side protection such as wrap around design or fixed side shields.**

The minimum acceptable eye protection is a spectacle (class 1A on chart Z94.3). Dark tinted spectacles will not be accepted for general indoor use. Additional eye and face protection is required for specific hazards. Chart Z94.3 outlines the appropriate PPE for specific hazards.

### **Foot Protection:**

- 1. Boot height- minimum 5 ½" uppers (6" boot), measured from the top of the sole.**
- 2. Leather Construction.**
- 3. CSA Green Patch rating.**

Safety boots must be properly laced and not be worn or damaged as to impair their effectiveness.

## Eye and Face Protection Passport

Refer to the attached chart Z94.3 to identify the required eye and face protection for the following scenarios:

1. Minimum eye protection required at all times in a Motive Power area where signage indicates that eye protection must be worn.

Answer \_\_\_\_\_

2. Required eye protection for testing lead acid batteries where a chemical hazard exists.

Answer \_\_\_\_\_

3. Required eye protection for Oxyacetylene cutting and welding.

Answer \_\_\_\_\_

4. Required eye protection for sandblasting using portable equipment (no contained sand blasting cabinet).

Answer \_\_\_\_\_

5. Grinding, drilling or chipping.

Answer \_\_\_\_\_

I acknowledge that my Instructor has explained this policy, and I understand that it is my responsibility to wear the appropriate eye, face, and foot protection.

Signed \_\_\_\_\_

Print Name \_\_\_\_\_

Date \_\_\_\_\_

**Chart Z94.3**

**Selection of Eye and Face Protection**

**Note:** This table cannot cover all possible hazards and combinations that may occur. Examine each situation carefully and select the appropriate protector or combination of protectors.

\*indicates recommended protection

	Spectacles (Class 1)			Goggles (Class 2)			Welding Helmet (Class 3)	Welding Hand Shield (Class 4)	Non-Rigid Hoods (Class 5)				Face Shields (Class 6)		
	A	B		A	B	C					A	B	C	D	A
<b>Flying Objects</b>															
Chipping, drilling, scaling, grinding, polishing, buffing, riveting, punching, shearing, hammer mills, crushing, heavy sawing, planing, wire and strip handling, hammering, unpacking, nailing, punch press, lathe work, etc.	*			*	*					*				*	*
<b>Flying particles, dust, wind, etc.</b>															
Woodworking, sanding, light metal working and machining, exposure to dust and wind, resistance welding (no radiation exposure), sand, cement, aggregate handling, painting, concrete work, plastering, material batching and mixing	*			*	*					*				*	*
<b>Heat, sparks and splash from molten materials</b>															
Babbling, casting, pouring molten metal, brazing, soldering, spot welding, stud welding, hot dipping operations		*			*										
<b>Acid splash, chemical burns</b>															
Acid and alkali handling, degreasing, pickling and plating operations, glass breakage, chemical spray, liquid bitumen handling					*					*				*	
<b>Abrasive blasting materials</b>															
Sand blasting, shot blasting, shotcreting				*						*					*
<b>Glare, stray light (for reduction of visible radiation)</b>															
Reflecting, bright sun and lights, reflected welding flash, photographic copying	*			*	*					*				*	*
<b>Injurious optical radiation (moderate reduction of optical radiation)</b>															
Torch cutting, welding, brazing, furnace work, metal pouring, spot welding, photographic copying															

**Example**

**Class 1**



**Class 2**



**Class 3**



**Class 5**



**Class 6**





<i>Injurious optical radiation (large reduction of optical radiation)</i>																				
Electric arc welding, heavy gas cutting, plasma spraying and cutting, inert gas shielded arc welding, atomic hydrogen welding							*					*								

## VII. PRIOR LEARNING ASSESSMENT:

Students who wish to apply for advance credit transfer (advanced standing) should obtain an Application for Advance Credit from the program coordinator (or the course coordinator regarding a general education transfer request) or academic assistant. Students will be required to provide an unofficial transcript and course outline related to the course in question.

Credit for prior learning will also be given upon successful completion of a challenge exam or portfolio.

**CICE Modifications:****Preparation and Participation**

1. A Learning Specialist will attend class with the student(s) to assist with inclusion in the class and to take notes.
2. Students will receive support in and outside of the classroom (i.e. tutoring, assistance with homework and assignments, preparation for exams, tests and quizzes.)
3. Study notes will be geared to test content and style which will match with modified learning outcomes.
4. Although the Learning Specialist may not attend all classes with the student(s), support will always be available. When the Learning Specialist does attend classes he/she will remain as inconspicuous as possible.

**A. Tests may be modified in the following ways:**

1. Tests, which require essay answers, may be modified to short answers.
2. Short answer questions may be changed to multiple choice or the question may be simplified so the answer will reflect a basic understanding.
3. Tests, which use fill in the blank format, may be modified to include a few choices for each question, or a list of choices for all questions. This will allow the student to match or use visual clues.
4. Tests in the T/F or multiple choice format may be modified by rewording or clarifying statements into layman's or simplified terms. Multiple choice questions may have a reduced number of choices.

**B. Tests will be written in CICE office with assistance from a Learning Specialist.*****The Learning Specialist may:***

1. Read the test question to the student.
2. Paraphrase the test question without revealing any key words or definitions.
3. Transcribe the student's verbal answer.
4. Test length may be reduced and time allowed to complete test may be increased.

**C. Assignments may be modified in the following ways:**

1. Assignments may be modified by reducing the amount of information required while maintaining general concepts.
2. Some assignments may be eliminated depending on the number of assignments required in the particular course.

***The Learning Specialist may:***

1. Use a question/answer format instead of essay/research format
2. Propose a reduction in the number of references required for an assignment
3. Assist with groups to ensure that student comprehends his/her role within the group
4. Require an extension on due dates due to the fact that some students may require additional time to process information
5. Formally summarize articles and assigned readings to isolate main points for the student
6. Use questioning techniques and paraphrasing to assist in student comprehension of an assignment

**D. Evaluation:**

Is reflective of modified learning outcomes.