# Course Design Document (Draft Version 11)

Module Title: Arterial Traffic Systems Operation

Prepared For Tasks 2 and 3

Development, Deployment, and Assessment of a New Educational Paradigm for Transportation Professionals and University Students: A Collaboration of the Region X Transportation Consortium

Federal Highway Administration
Transportation Education Development Pilot Program


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In each section, there is an overview of what type of content should be created for that section, and some tips for the creation and formatting of the content. *An example of materials created for the Arterial Traffic Signal Operation Module is provided in italics at the end of each section.*

## 1. INTRODUCTION

This report represents the results of work completed as part of Tasks 2 and 3 of the project "Development, Deployment, and Assessment of a New Educational Paradigm for Transportation Professionals and University Students: A Collaboration of the Region X Transportation Consortium." The tasks focus on (1) the development of a guidance document for the development of course modules and (2) the development of the educational materials based on this guidance document.

The project is being undertaken as part of the Federal Highway Administration's Transportation Education Development Pilot Program. This project has established several ambitious goals, including:

1) The development of a distance learning environment
2) A student focus in an active learning environment
3) A hands on approach to learning

This report serves as the course design document for the module "Arterial Traffic Systems Operation", a ten week course that will be presented in a distance learning environment to professional transportation engineers and graduate students who want to learn how to design a traffic operations plan for an arterial that serves a variety of users, including vehicles, pedestrians, and transit vehicles. The next step in Task 3 is to develop the course materials that are based on this design document. This report will also serve as the guidance document for the development of the other three modules to be developed as part of this project.

This document is based on the curriculum design process developed by Apple, Beyerlein, and others [Pacific Crest Handbooks: Course design, Activity design]. It is summarized in Figure 1. The process consists of several steps beginning with an analysis of the potential audience and the context for the class. This is followed by an iterative course design process where items like the course-level learning outcomes, knowledge table, and learning skills are focused using feedback from the weekly and activity level.

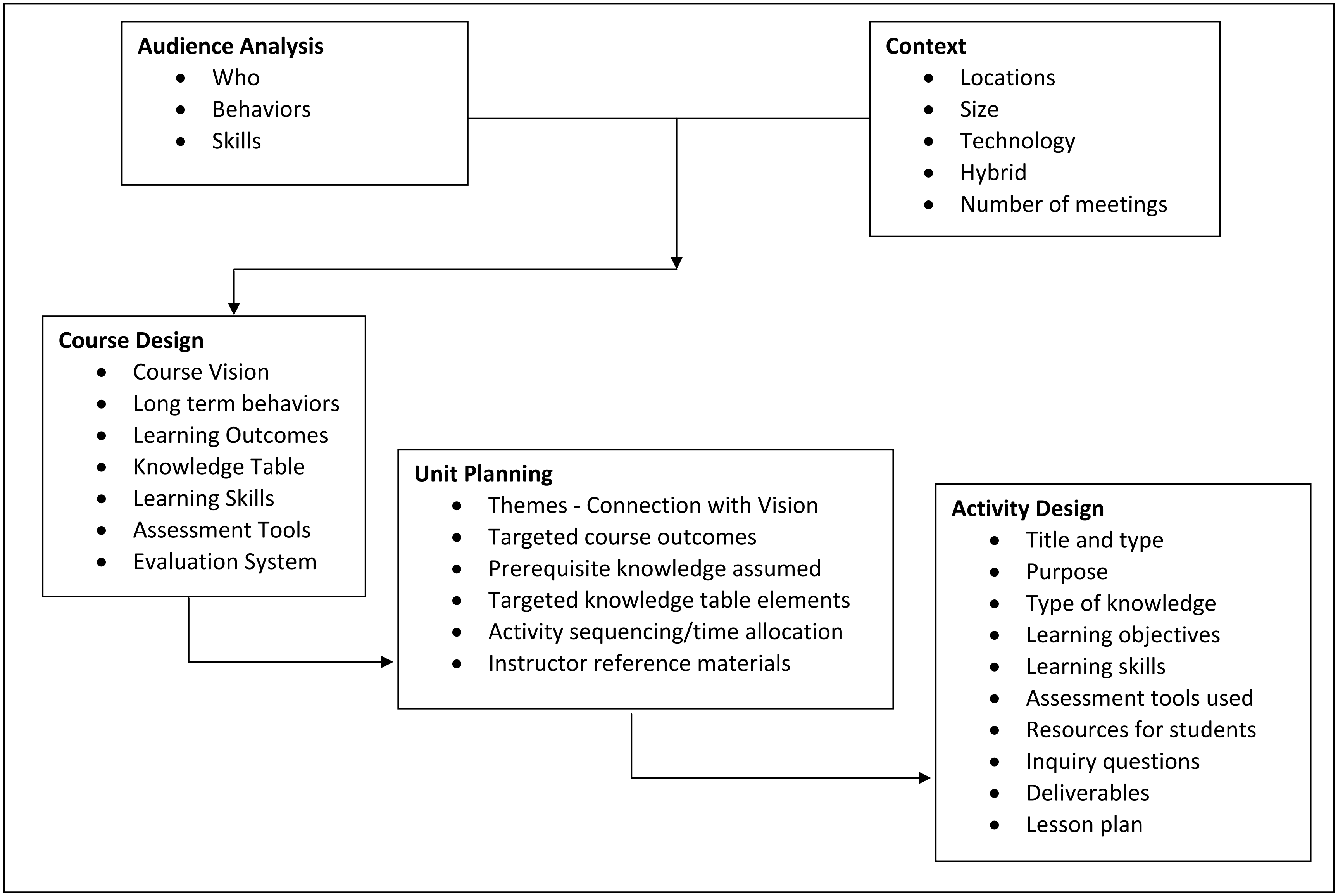


**Figure 1: Course Design Process**

## 2. AUDIENCE ANALYSIS

An audience analysis ensures that a course is designed to serve the intended population of students. This analysis also includes visualization of long-term behaviors that a course is intended to promote, beyond the end of the course and into professional practice. The audience analysis should capture who they are, and what they know. This includes likely distribution in age, education, experience, physical location, and technical background of the students. It is helpful to identify several professional roles that students can identify with and in which they can grow throughout the course.

*The project team identified potential audiences for the arterial traffic design course using data collected from the participants of the MOST project, a recently completed project designed to improve traffic signal timing skills based on an active and hands on learning environment [MOST Textbook]. It was clear that the level of education and engineering experience varies across potential participants and this will impact the quantity of new knowledge that can be mastered by different audiences. Three distinctly different audiences are expected in the new course:*

- *Junior engineers and graduate students*
- *Senior engineers with 8 plus years experience*
- *Technicians*

*It was decided that this would not be a first course in transportation, but rather an advanced course that presupposed the type of preparation that could be expected from an upper-level undergraduate transportation engineering course.*

*The long term behaviors that we expect to mold through this course were also discussed. The discussion was based on the profile outlined in The Vision for Civil Engineering in 2025 [American Society of Civil Engineers]. The ASCE document highlights major attributes of the future civil engineer, including knowledge, skills, and attitudes. These attributes were discussed in detail and long-term behaviors associated with five professional roles were envisioned to be supported by the course.*

- *Designer*
- *Technologist (modeler, equipment specialist, diagnostician)*
- *Communicator*
- *Collaborator*
- *Public Servant (professional, ethical, civic-minded engineer)*

## 3. COURSE ENVIRONMENT

Physical and temporal constraints surrounding delivery of the course need to be established before significant progress can be made in course design. This includes the location of faculty and students, the number and type of contact hours, expectations of work outside of class, and the level of interaction between participants outside of formal class meeting times.

*Logistics and course contextual issues for the arterial traffic design course were identified and documented. The fall was determined to be the best time to offer the course because both semester and quarter systems have a ten week period that overlaps. The number of credits, hours, predicted student time commitment, and types of work were outlined and summarized in the table below.*

| ***Credit Hours*** | ***Student Time Commitment*** | ***Types of Student Work*** |
|---|---|---|
| • *3 credits for quarter system students*<br>• *2 credits for semester system students* | • *Approximately 30 contact hours with an average of two hours outside class for every contact hour* | • *Individual*<br>• *Local class work*<br>• *Distance class work*<br>• *Local teamwork*<br>• *Distance teamwork*<br>• *Retreat environment/experience* |

*Including a two to three day face-to-face workshop at the beginning of the course was discussed but no consensus was reached, amongst the project team. Arguments for the workshop were that face-to-face interaction between students is beneficial to learning. Arguments against the workshop were the logistical considerations of matching the schedules of quarter system students, semester students, working professionals, and technicians along with the cost considerations of traveling to a common site. It was suggested that the instruction team travel to meet with students rather than expect the students to travel to a common location. This way the instruction team will facilitate the communication technologies and aids in the introduction and orientation of the students.*

## 4. COURSE VISION

It is important to articulate an overall theme for the course that briefly describes the course in a way that can promote brainstorming about course content, course activities, faculty preparation, and marketing to potential students. Ideally the vision should connect cognitive, social, and affective dimensions of the course. The vision is not static, it can be strengthened as learning outcomes are articulated, course knowledge is classified, and learning activities are scoped and sequenced. The vision serves to align and validate course components and delivery strategies. To create an effective course vision it is helpful to isolate a phrase that will resonate with important course stakeholders and offers insight about what is expected to be unique and exciting about the course. The course vision is the source of various themes that can unify week-by-week course design.

The following vision was crafted for the arterial traffic design module:

***Building a Community of Traffic Operations Professionals*** *-- engaging academic, industry, government, and community stakeholders in case-based use of state-of-the-art simulations, traffic control equipment, and decision support tools to create efficient traffic corridor designs.*

## 5. LEARNING OUTCOMES

Learner performance is more likely to improve if one is able to precisely define what is to be achieved along with how this performance can be documented at the end of a learning experience. The number of learning outcomes for a course should be small enough so individual outcomes can be revisited several times throughout the course and the set of learning outcomes for a course should be varied enough to make learning activities realistic. For a typical 3-credit engineering college course a good target is 5-7 competency outcomes, 2-4 movement outcomes, 1-2 experience outcomes, 0-1 accomplishment outcomes, and 1-2 integrated performance outcomes. For a typical engineering course, the number of competency outcomes is often equal to the total number of movement, experience, and integrated performance outcomes.

Learning outcomes should be phrased such that they describe student behaviors that are developed by the end of the course. Learning outcomes provide a vector for development in relevant learning activities. In contrast, learning objectives for each learning activity are intermediate milestones that can be achieved at the end of the learning activity.

It is helpful to separate different types of learning outcomes that are common in higher education: competencies, movement, experiences, accomplishments, and integrated performance. Each of these outcome types addresses a different aspect of learning. Each type is best suited to different educational methods and requires collecting different evidence to demonstrate that the outcome has been achieved.

**Competency outcomes** are tasks that learners must perform at a prescribed level in a specific context. Competency outcomes typically probe lower to mid levels in Bloom's taxonomy (i.e. remember, understand, apply, or analyze). Competency outcomes are snapshots of what learners can do at a specific point in time, and they are relatively easy to measure. Common learning activities that support competency outcomes are guided discovery, and active learning. To promote long-term retention of competency outcomes, it is advisable to target at Bloom's level of "apply" or above. **Examples:**

1. Find all positive real roots of a second-order polynomial using the quadratic formula.
2. Use a decision matrix to defend a solution from among multiple alternatives, customer requirements, and resource limitations.

**Movement outcomes** focus on personal and professional development. They prescribe a desired direction and magnitude of growth that extend well beyond the present capabilities of all learners. Movement outcomes require samplings over time to establish whether real growth as occurred. Common learning activities that support movement outcomes are peer and self assessments, logbooks, and self-growth papers. **Examples:**

1. Translate word problems in to symbolic equations with greater speed and accuracy.
2. Manage project knowledge, resources, and the work environment to produce a more effective design product in a timely manner, and within budget.

**Experience outcomes** capture changes in attitudes, values and behaviors that result from life-changing experience. They should reveal awareness and critical analysis of the causes and impacts of personal changes in the learner. Common learning activities that support experience outcomes are team projects, seminars led by guest facilitators, and field trips. Common measurement tools for experience outcomes are personal interviews, focus groups, and reflective writing. **Examples:**

1. Serve as a tutor once a week throughout a semester in a math laboratory at a local high school, advancing your confidence in learning mathematics.
2. Gain appreciation of professional practice through interactions with clients, mentors, team members, and support staff in a year-long product development project, documenting issues and discoveries in a journal that illustrates formation of a personal design philosophy.

**Accomplishment outcomes** are recognized through outside affirmation from other faculty, alumni, or practitioners in the field. They are worthy of mention on a resume. Common learning activities that support accomplishment outcomes are project work, service learning, and formal presentations. Common measurement tools for accomplishment outcomes are testimonials, awards, and recommendations. **Examples:**

1. Place in the top 10% at a student math league competition.
2. Produce a design product that impresses a client, your peers, and the general public at a year-end design show and wins an award while at the same time meeting key functional performance specifications so that the product is used by the client.

**Integrated performance outcomes** require extension and transfer of knowledge, skills, and perspectives in response to challenging situations which are new and meaningful to the learner. Integrated performance outcomes typically probe upper-levels of Bloom's taxonomy (i.e. analyze, evaluate, or create). Common learning activities that support integrated performance outcomes are role playing, creative performances, and capstone projects. Common measurement tools for integrated performance outcomes are formal performance appraisals and feedback from an external review. **Examples:**

1. Use mathematical skills developed in this course to formulate, analyze, and report quantitative results related to a scientific experiment in your lab course.
2. Display professionalism in forming client relationships, assuming team responsibilities, achieving consensus, fulfilling commitments, applying prior knowledge, and conducting self-directed learning in a Capstone Project Course.

Establishing a strong set of learning outcomes for a course is an iterative process. Time should be spent early on to create a fairly complete initial draft that encompasses all types of relevant outcomes for the course. Another way to develop the set of course outcomes is to inventory a large list of learning objectives, find a logical groupings of objectives, determine the highest level of performance desired within each grouping, and write an outcome statement that defines this level of performance.

**Table 1: Learning Outcomes – Arterial Traffic Signal Operation Module**

| ***1. Competencies*** | ***2. Movement*** | ***3. Experience*** | ***4. Integrated performance*** |
|---|---|---|---|
| *1.1 Synthesize visual observations of traffic flow and traffic control system processes to identify changes needed in the traffic control system.*<br>*1.2 Apply traffic analysis tools such as the queue accumulation polygon, critical movement analysis, and traffic simulation to produce system performance measures.*<br>*1.3 Appropriately use the following information to characterize the quality of traffic flow at an intersection: delay, volume/capacity ratio, queue length, and cycle failure rate.*<br>*1.4 Program traffic signal controllers with phasing plans, timing data, and detector maps.*<br>*1.5 Produce an arterial signal timing plan that effectively serves a variety of corridor users, including vehicles, pedestrians, bicyclists, and transit.* | *2.1 Actively engage in and lead technical discussions within small groups*<br>*2.2 Document insights and discoveries from small group discussions that can be shared with others*<br>*2.3 Use multiple forms of data, multiple vantage points, and state-of-the-art analysis tools to Identify root causes of traffic problems*<br>*2.4 Propose and defend solutions to traffic problems that are acceptable to all stakeholders* | *3.1 Construct understanding using a simulation tool*<br>*3.2 Receiving feedback on design work by transportation professionals and external stakeholders* | *4.1 Create a robust corridor design for a transportation agency that addresses all stakeholder needs (in written and oral formats)* |

## 6. KNOWLEDGE TABLE

A knowledge table identifies the content you want students to know and how students can most effectively explore this knowledge. The knowledge table surfaces key concepts, identifies important processes and tools, suggests important contexts for learning, and reinforces important long term behaviors.

**Concepts** are ideas that connect a set of relationships. Concepts are representational and abstract. Concepts are best introduced with definitions, pictorial representations, and interactive learning objects.

**Processes** are a sequence of steps, events, or activities that result in a change or that produce something over a period of time. Processes are active and continuous. Processes are best introduced through methodologies that guide users through a sequence of steps with quality standards. Processes focus on actual performance, not just understanding what to do.

**Tools** are any device, implement, instrument, or utensil that serves as a resource to accomplish a task. Tools can be in paper form (templates), electronic form (software/simulation), or physical form (laboratory hardware). Tool knowledge includes selection and use of the tool, not just understanding its features or its typical use.

**Contexts** are the whole situation, background, or relevant conditions surrounding learning. Contextual knowledge is needed for experience outcomes. Contextual knowledge focuses on adaptation to varied conditions, not changes in basic processes.

**Ways of being** are sets of behaviors, actions, and language associated with a particular discipline, knowledge area, or culture. Ways of being reflect preferences and tacit assumptions, not understanding of concepts or processes.

Construction of the knowledge table is also an iterative process. Even after the initial knowledge table is completed, it should be revisited as more details at the weekly and activity level are completed to capture important decisions about course content. Issues exposed in the generation of a knowledge table include the following:

1. If there is excessive ambiguity in the distinctions among the five forms of knowledge within a map, e.g., by overlapping concepts with processes, learning activities may also lack appropriate focus.
2. If the descriptions and details used to represent the five forms of knowledge within a knowledge map are disjointed, e.g., lacking in integration or parallelism, multiple problems in learning and assessing performance are likely.
3. If there is not enough detailing or complexity in how the forms in the map are represented, learners may not fully recognize relevant exemplars or models, and educators may find it difficult to provide clear assessments.

**Table 2: Knowledge Table– Arterial Traffic Signal Operation Module**
**(bold text=elements incorporated in pilot course; unbolded text = desired elements not emphasized in pilot course))**

| ***1. Concepts*** | ***2. Processes*** | ***3. Tools*** | ***4. Contexts*** | ***5. Ways of being*** |
|---|---|---|---|---|
| ***1.1 Traffic flow models, considering the interaction of demand, geometry, and control***<br>***1.2 Traffic control systems, including the user, detection, control, and display components***<br>1.3 ***Performance measures (including delay, travel time, volume capacity ratio, queue length) that result from the interaction of demand, geometry, and control*** | ***2.1 Signal timing design process***<br>***2.2 Traffic analysis process***<br>***2.3 Planning process***<br>***2.4 Alternatives analysis process***<br>***2.5 Problem solving: developing alternative solutions.*** | ***3.1 Traffic modeling tools***<br>***3.2 Traffic controllers***<br>*3.3 Communications tools: Video conferencing, conference calls, chats, e-mail.*<br>***3.4 Traffic data resources: Data archives, data collection methods***<br>3.5 ***Technical resources: texts, manuals, journals*** | ***4.1 Intersection configurations (left turn phasing, exclusive lanes, close-spacing )***<br>***4.2 Operating conditions (uncongested, congested)***<br>*4.3 Professional perspectives (engineer, decision maker, citizen)*<br>***4.4 Design review environments (self, peer, instructor)***<br>***4.5 Discussion forums (face-to-face,*** *asynchronous, Skype)* | ***5.1 Designer***<br>***5.2 Tool user***<br>***5.3 Communicator***<br>***5.4 Collaborator***<br>*5.5 Ethical civic minded engineer* |

## 7. LEARNING SKILLS

Learning skills are discrete entities that are not knowledge or discipline specific and are therefore transferable across many areas of human experience. They can be consciously improved and refined. Once they are improved, the rate and effectiveness of overall learning increases. No matter what a person's age or experience, learning skills have no upper bound. They can always be improved. Learning skill development is usually triggered by a learning challenge of some kind that forces the student to use or further develop a certain set of skills and is facilitated through mentoring.

Candidate skills can come from three domains: cognitive, social, and affective. A well-designed course will feature 15-20 learning skills that complement course content. The learning skills targeted for a course should be ones that students frequently struggle with as opposed to skills that are already highly developed. Table 3 maps learning skills to long-term behaviors resulting from the arterial traffic signal module.

**Table 3: Learning Skills– Arterial Traffic Signal Operation Module**

| ***Cognitive skill*** | ***Associated long term behavior*** | ***Social skill*** | ***Associated long term behavior*** | ***Affective skill*** | ***Associated long term behavior*** |
|---|---|---|---|---|---|
| *Recognizing patterns* | *a, b, c, d, e* | *Checking perception* | *a, b, c, d, e* | *Perceiving reactions* | *e* |
| *Validating sources* | *a, b,* | *Sharing knowledge* | *c, d, e* | *Being positive* | *c, d, e* |
| *Identifying inconsistencies* | *a, b* | *Compromising* | | *Appreciating evaluation* | *e* |
| *Inquiring* | *a, b, c, d, e* | *Persuading* | *c, d, e* | *Seeking assessment* | *e* |
| *Integrating* | *a, b, c, d, e* | *Collaborating* | *d* | *Preparing* | *a, b, c, d, e* |
| *Contextualizing* | *a, b* | *Negotiating* | *c, d, e* | *Objectify emotions* | *c, d, e* |
| *Envisioning* | *a, b* | *Appreciating diversity* | *e* | *Recognizing personal potential* | *e* |
| *Diagramming* | *b* | *Building consensus* | *c, d, e* | *Self actualizing* | *e* |
| *Recognizing the problem* | *a, b* | | | | |
| *Identify constraints* | *a, b* | | | | |
| *Ensuring value* | *a, b* | | | | |

| ***Long term behavior*** | ***Role*** |
|---|---|
| *a* | *Designer = a designer understands the fundamental knowledge of engineering and uses it in design.* |
| *b* | *Technologist (modeler, equipment specialist, diagnostician) = apply basic engineering tools, such as statistical analysis, computer models, design codes and standards, and project monitoring methods.* |
| *c* | *Communicator = communicate with technical and non-technical audiences, convincingly and with passion, through listening, speaking, writing, mathematics, and visuals.* |
| *d* | *Collaborator = collaborate on intra-disciplinary, cross-disciplinary, and multi-disciplinary traditional and virtual teams.* |
| *e* | *Public Servant (professional, ethical, civic-minded engineer) = thoroughness and self-discipline in keeping with the public health, safety, and welfare implications for most engineering projects and the high-degree of interdependence within project teams and between teams and stakeholders.* |

## 8. ASSESSMENT AND EVALUATION TOOLS

There are many ways to provide assessment and collect evaluation. Care should be taken to match the tool with the type of outcome being measured. For each outcome it is beneficial to use multiple tools to improve accuracy of the measurement. It is also more efficient to select tools cut across multiple outcomes in order to minimize the number of measurements being accounted. Table 4 provides some guidelines mapping learning outcomes with typical tools.

**Table 4: Matrix for matching tool with outcome type**

| | Competency | Movement | Experience | Accomplishment | Integrated Perf. |
|---|---|---|---|---|---|
| **Homework (Problem set)** | X | X | | | |
| **Homework and Quizzes (Short answer)** | X | | | | |
| **Exams** | X | X | | | |
| **Assessments (peer, self)** | | X | X | | |
| **Logbooks** | | X | X | | |
| **Self-growth papers** | | | X | | X |
| **Recorder Reports (Team discussions)** | | X | X | | |
| **Team citizenship assessment** | | X | | | |
| **Progress reports** | | X | | | |
| **Final report** | | | | | X |
| **Video presentation** | | | X | | X |
| **Oral Exam** | | | | | X |
| **Survey (pre-course)** | X | | X | | |
| **Conference presentation** | | | | X | X |
| **Design review (with external stakeholders)** | | | X | | X |

## 9. COURSE GRADING SYSTEM

Because teamwork is an important skill for engineers, team-based assignments should be part of the course grading system. It is also important to measure the understanding and performance abilities of the individual. If there is a project/design component of the course, then there needs to be further delineation between project and non-project work. A general rule of thumb is 50% individual, and 50% group. Depending on the size and complexity of the project, as much as 50% of the course grading system can also be related to project work.

The distribution for the Arterial Traffic Signal Operation module is shown below:

| | |
|---|---|
| ***Individual, non-project (40%)*** | |
| *In-class quizzes* | *10%* |
| *Final exam* | *20%* |
| *Homework* | *10%* |
| ***Group, non-project (10%)*** | |
| *Recorder reports* | *10%* |
| ***Individual, project (20%)*** | |
| *Team citizenship assessment* | *10%* |
| *Home video* | *10%* |
| ***Group, project (30%)*** | |
| *Intermediate reports* | *10%* |
| *Final report* | *20%* |

It is useful for students to have a guideline for expectations on assignments. For most evaluation tools a lot can be learned and communicated through use of a rubric. The rubric should divide the task in to several categories or components. Then descriptions of what performance in those categories looks like at various levels should be added so the students have an idea of what is expected of them. Table 8 shows a sample rubric for solution to a typical engineering homework problem. For further information on creating rubrics, there are some great online tools such as Rubistar.

Table 5: Rubric for design reports

| **Team:** | | **Reviewer:** | | |
|---|---|---|---|---|
| | | **Member reviewed:** | | |
| | **Score** | | | |
| | **4** | **3** | **2** | **1** |
| **Category** | **All elements clearly demonstrate high expertise** | **All elements meet requirements** | **Some elements miss requirements** | **Pervasive lack of effort** |
| Vocabulary (10%) | • **Understanding** of terms increased in audience.<br>• **Used** comfortably and correctly. | • **Understanding** of terms static in audience.<br>• **Used** and was stilted, but correct. | • **Understanding** of terms limited.<br>• **Used** and was stilted, some noticeable errors. | • **Understanding** frequently lacking.<br>• **Used** no technical terms, noticeable errors. |
| Comprehension (20%) | • **Presented** deep meanings and required analysis<br>• **Answered** accurately and clearly. | • **Presented** required analysis<br>• **Answered** accurately, minor clarity issues. | • **Presented** incomplete analysis<br>• **Answered** semi-accurately, significant repetition required. | • **Presented** disorganized inconclusive analysis<br>• **Answered** nothing, tried but failed to explain. |
| Visual aids (20%) | • **Supported** explanations, questions, concepts; visibly anticipated all.<br>• **Communicated** points with no interpretive remarks required. | • **Supported** explanations, questions, concepts; visibly anticipated some.<br>• **Communicated** points, some interpretation required by presenter. | • **Supported** concepts; did not anticipate some.<br>• **Communicated** few points, substantial interpretation required, many bulleted lists. | • **Supported** concepts vaguely; visibly poor planning.<br>• **Communicated** no points, substantial interpretation required, all bulleted lists. |
| Comments understood (20%) | • **Relate** to technical areas in big picture and in details, valuing input. | • **Relate** to technical areas in big picture and details. Input less valued. | • **Relate** to technical areas missing some key points. Input recognized little. | • **Relate** to technical areas missing some key points. Input recognized little. |
| Stakeholder buy-in (30%) | • **Address** concerns with clear, convincing, explanations, showing merits. No remaining doubts. | • **Address** concerns with clear, explanations, show some merits. Some remaining doubts. | • **Address** concerns with explanations, showing few merits. Many doubts. | • **Address** concerns with faulty explanations, shows no merits. won't work. |

## 10. UNIT PLANNING TEMPLATE

These templates are to be used by the faculty to give detail to each of the weeks in the course.

| **UNIT NAME:** | | |
|---|---|---|
| Themes | These trace the unit to one or more elements in the course vision. | |
| Course outcomes supported | Course outcomes are selected for emphasis in this segment of the course. | |
| Prerequisite knowledge | This defines what students need to know and be able to do before learning activities can be successfully undertaken. | |
| Knowledge table elements | All components of anticipated learning activities are inventoried, classified, and have prominence in the knowledge table for the course. | |
| Sequencing and time allocation | Activity names are forecast and approximate durations are specified within the time constraints for the course. | xx minutes |
| | | xx minutes |
| | | xx minutes |
| Reference materials | These are the knowledge sources and tools that instructors will be used to create the learning activities. | |

## 11. ACTIVITY DESIGN TEMPLATE

These templates are to be used by the faculty to give details will be useful in the creation of each activity.

| **Activity title** | Memorable and meaningful label for the activity |
|---|---|
| Activity type | Pre-class, In-class, or Post-class |
| Time allocated | xx minutes |
| Purpose | Statement that explains why the activity is important, how this supports course outcomes, and what can students expect to experience in the planned activity. |
| Learning tools | Entity that will be studied in the activity to support the form of knowledge intended for development:<br>Concepts are supported by concept models.<br>Processes are supported by methodologies.<br>Tools are supported by tutorials.<br>Contexts are supported by case studies.<br>Ways of being are supported by profiles of performers. |
| Learning objectives | Two or three observable things that will be produced or enhanced through completion of the learning activity. |
| Learning skills | Two or three learning skills that are likely to be critical in meeting the learning objectives and whose growth can be facilitated |
| Assessment tools | Subset of course tools that will be used to collect data on performance related to the activity. |
| Resources for students | Materials students will have access to during the activity. |
| Inquiry questions | Structured set questions whose answers will facilitate construction of the desired knowledge form. |
| Lesson plan | Notes on how the activity will be set up, how individual and group work will be facilitated, and what will be done for closure. |
| Deliverables | Things that will be produced during or after the activity. |

## 12. ACTIVITY FORM

This form is the actual activity that will be used and seen by students

**Title:**

**Purpose:**

**Learning objectives:**

**Tasks (things to do):**

**Resources:**

**Deliverables:**

## 13. LESSON PLAN

This form is intended to help other instructors replicate learning experiences.  This consists of a set of notes that a new instructor "takes into the classroom" to guide and facilitate the work of the students. A convenient way to generate this is to have a colleague observe the class as a peer coach and record what he/she observes.

**Set up:**

**During the activity:**

**Closure:**