



# I USER MANUAL



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## *What is IMoDS?*

*The lack of formal educational training is often a barrier that hinders STEM educators in their efforts to produce highly effective course curriculum. Educators often rely on teaching methods that they were exposed to as students, without evidence as to whether these methods are the most effective way of teaching a particular topic. The Instructional Module Development System (IMOD) was created as a means assisting STEM professors to improve their courses by allowing them to identify the most effective methods of teaching target concepts and skills.*

*IMODS is a web-based, curriculum design application that walks users through an outcome-based curriculum design process. For educators unfamiliar with outcome-based curriculum, the application acts as a tutorial, detailing the essential aspects of an outcome-based curriculum. Educators can move through the IMOD system step-by-step and, in the process, learn how to apply outcome-based design to their courses while they are actually designing a course. Educators who are already familiar with outcome-based design will find that IMOD makes documentation of course information and finding new instructional and assessment techniques simple and systematic.*

## *Terminology*

- *Outcomes – Specific, measurable goals that the learner should be able to achieve*
- *Learning Domain – Levels of learning divided into domain categories*
- *Domain Categories – The learning activities that form the learning domains, arranged from simplest to complex*
- *Learning Objectives – A way in which an instructor can inform others of what he/she intends for the students to achieve; defined first and focused on outcomes*
- *Condition – The conditions under which the learner should be able to achieve the outcome*
- *Criteria – How well the learner must be able to achieve the outcome; used to determine the acceptability of the performance*
- *Performance – What the learner should be able to do; performance is to be carried out under certain conditions*
- *Context – Environment in which learning takes place*
- *Content – What content is being taught as a part of the instructional module*
- *Pedagogy – Help to define the learning activities or instructional activities that the instructor would utilize to convey the subject matter, i.e., content*
- *Assessments – Contain all the assessment pieces designed for the objectives defined in the learning objective feature*
- *Action word – Learning action*
- *Generic condition – Should include target audience and instructional module type*

## *Bloom's Taxonomy*

*Bloom's Taxonomy is a model that is used to classify the objectives of educational learning into three domains – Cognitive, Affective and Psychomotor. It was designed in the year 1956 by Dr. Benjamin Bloom. It was later revised by one of Dr. Bloom's students, Lorin Anderson and David Krathwohl. It is this revised taxonomy that has been used as the basis for designing the IMODS tool.*

*Each of the three learning domain in turn have several domain categories. Since the focus of the tool is on STEM education, almost all of the possible learning objectives fall under the Cognitive domain. The revised Cognitive domain has six domain categories. Each of them has a set of action words associated with them that is usually the main action that is expected as the outcome of a learning objective. For IMODS, we have one more level of abstraction that basically has action word categories encompassing all possible action words for a particular category. A list of action words category for each of the domain categories is given below.*

- *Remember –recall, recognize*
- *Understand – classify, compare, exemplify, explain, infer, interpret, summarize*
- *Apply – execute, implement*
- *Analyze – attribute, differentiate, organize*
- *Evaluate – check, critique*
- *Create – generate, plan, produce*

*The action words are usually an important component in defining learning objectives and is the basic building block of framing it. This guides the rest of the process of adding further content, criteria and condition for the objective.*

## *System Structure*

*IMOD separates each course into five main areas: Context, Learning Objectives, Content, Pedagogy, and Assessment. When creating an IMOD (instructional module), the user is expected to proceed through each of these areas in an ordered manner; however, certain features (e.g. technique matching in the Pedagogy and Assessment areas) can be used independently. There is also a help video that has been designed to assist the user in course design.*

### *Help Dialog*

*All the tabs have a help dialog on the right side which contains a help video and some tips on how to work with a particular tab. This is included in order to help the user better understand the tabs and get reference during course design.*

### *Course Overview*

*The context of a course details basic information about how the course will be delivered, e.g. schedule, instructor information, location. The goal of the context section is to “describe the environment in which the learning takes place.” IMOD captures this information in the Course Overview tab, which is the first tab the user comes to when creating an IMOD.*

Course Overview	Learning Objectives	Content	Assessment	Pedagogy	
<input type="button" value="Show Syllabus"/> <input type="button" value="Save"/> <input type="button" value="Delete"/>					
<b>Course Details</b>		<b>Schedule</b>			
Course Title *	Object-Oriented Software D	Start Date *	31	March	2017
Course Number *	CST100	End Date *	31	March	2018
Course URL	https://piazza.com/asu/spri	Start Time *	18	: 00	: 00
Classroom Location	Peralta 213	End Time *	19	: 15	: 00
Semester	Fall 2015	Repeats	Daily		
		Repeats Every	Nothing Selected Days		

Figure 1 - Course Details and Schedule

Course Description	Course Policy
<b>Overview</b> Introduces problem solving with a state-of-the-art programming language. Expressions, statements, basic control flow and methods. Data, data aggregation and usage.	<b>Grading Procedure</b> <input type="radio"/> Competency-Based <input checked="" type="radio"/> Standardized <input type="radio"/> Custom
<b>Subject Area *</b> Computer Science	<input type="checkbox"/> Attendance and Tardiness <input type="checkbox"/> Class Participation <input type="checkbox"/> Professional Conduct <input type="checkbox"/> Missed Exams/Make-up Exams <input type="checkbox"/> Missed Assignments
<b>Audience</b> No Audience Lower Division Upper Division Undergraduate Graduate	
<b>Credit Hours</b> 3	
<b>Time Ratio</b> 1:3 *Time spent in and out of class. eg: 1:2"	
<b>Number Of Seats</b> 30	

Figure 2 - Course Description and Course Policy

Instructors						
First Name	Last Name	Email	Office Hours	Web Page	Role	Office Location
<input type="checkbox"/>	Rehman	Chughtai	Rehman.Chughtai	by email appointme	Assistan	Peralta 235 (Bullpen)
<input type="checkbox"/>	Dr. Ajay	Bansal	ajay.bansal@asu.	Tuesdays & Thursd	Professc	Peralta 230V

Figure 3 - Instructors

## Learning Objectives

As an outcome-based curriculum design application, IMOD emphasizes the creation of detailed, clear, and specific learning objectives. Learning objective are defined by allowing the user to independently identify three essential aspect of a learning objective: Performance, Criteria, and Condition.

During performance definition, the user identifies the skills or tasks that the learner should acquire through the course. Each learning objective is defined by one key action word, which is chosen on the Performance sub-tab of the Learning Objectives tab. The user

identifies the action word by first identifying a target Learning Domain (Cognitive, Psychomotor, or Affective) of the target skill, and then choosing the activity type (i.e. the Domain Category) from a predefined list. The action word must be displayed as part of the learning objective statement.

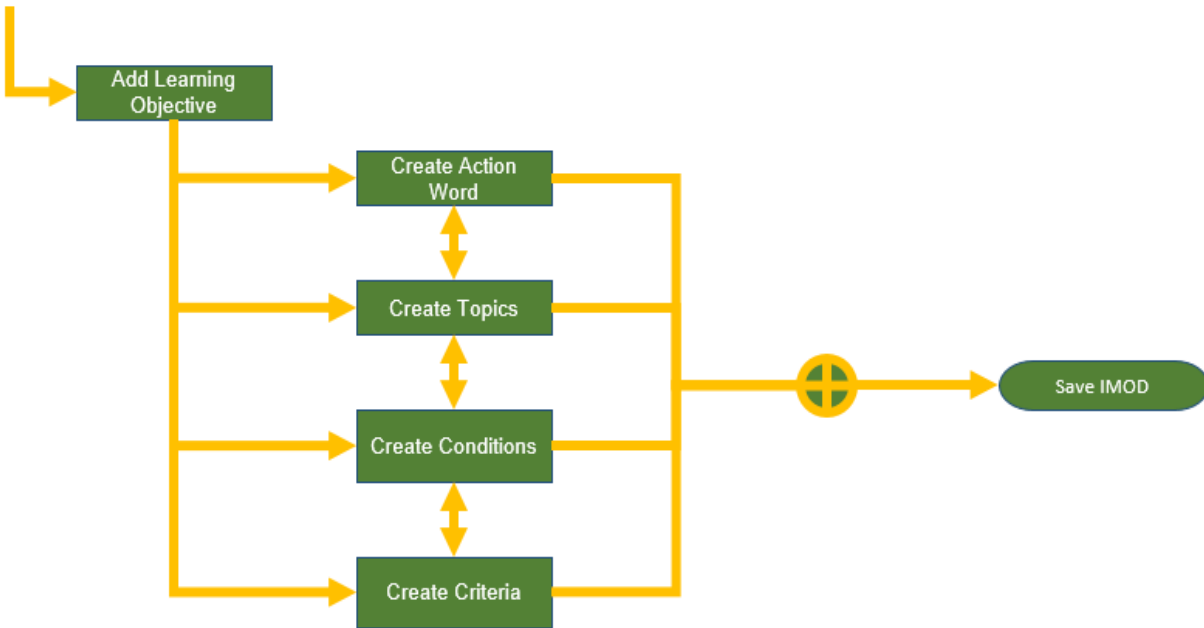


Figure 4 - Learning Objectives Flow Diagram

Figure 5 - Learning Objectives Performance Tab

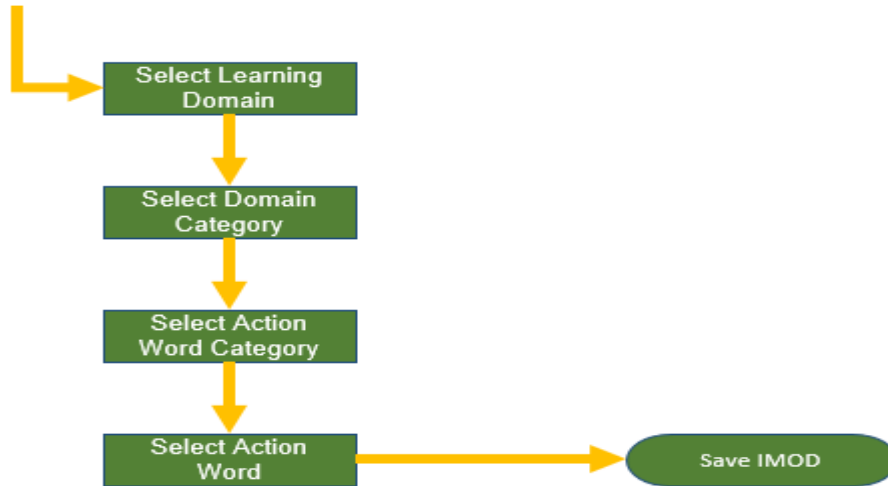


Figure 6 - Performance Tab Flow Diagram

During criteria definition, the user identifies how well the learner will be required to achieve the outcome. The user is able to enter criteria in four areas: speed, quantity, accuracy, and quality. For a given learning objective, criteria in one or more areas may be relevant. The user can choose to incorporate some all or none of the criteria information into the learning objectives statement.

**(LO1) Given a problem specification apply Iteration, Constructing Algorithms, Constructing Formal Code, Selection, Sequence, and Problem Solving 85%**

	Performance	Content	Condition	Criteria
<input checked="" type="checkbox"/> Accuracy	85%			<input checked="" type="checkbox"/> Hide from Students
<input checked="" type="checkbox"/> Quality	with perfection			<input checked="" type="checkbox"/> Hide from Students
<input checked="" type="checkbox"/> Quantity				<input checked="" type="checkbox"/> Hide from Students
<input checked="" type="checkbox"/> Speed				<input checked="" type="checkbox"/> Hide from Students

[Save](#)

Figure 7 - Learning Objectives Criteria Tab

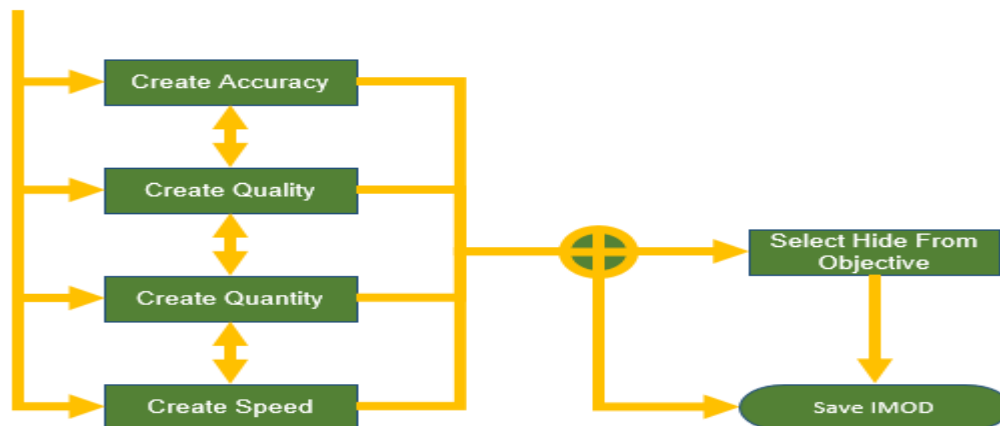


Figure 8 - Criteria Tab Flow Diagram

During condition definition, the user explains the conditions under which the learner should be able to achieve the outcome. The user may choose a generic or custom condition. As with criteria, information from the condition subtab may be displayed in the learning objective or hidden from view.

**(LO1) Given a problem specification apply Iteration, Constructing Algorithms, Constructing Formal Code, Selection, Sequence, and Problem Solving 85%**

Figure 9 - Learning Objectives Condition Tab (Custom)

**(LO1) Given a problem specification apply Iteration, Constructing Algorithms, Constructing Formal Code, Selection, Sequence, and Problem Solving 85%**

Figure 10 - Learning Objectives Condition Tab (Generic)

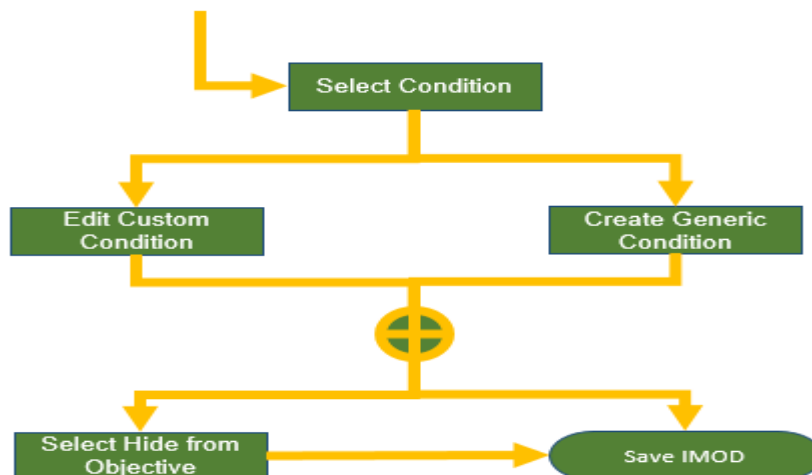


Figure 11 - Condition Tab Flow Diagram



It can be seen how the learning objective gets automatically constructed based on all the inputs and selections. The user can refine the learning objective by clicking on the edit button right next to the learning objective on the top (LO1 in the above image).

This can be illustrated by the example below –

*Learning Objective – Given a problem specification apply Iteration, Constructing Algorithms, Constructing Formal Code, Selection and Sequence and Problem Solving with 85% accuracy and speed*

*Learning Domain -> Domain Category -> Action Word Category-> Action Word –(apply)*

*Select Content – Iteration, Constructing Algorithms, Constructing Formal Code, Selection and Sequence and Problem Solving*

*Select Condition – Given a problem specification,*

*Select Criteria – 85%(accuracy) determined per assessment (speed)*

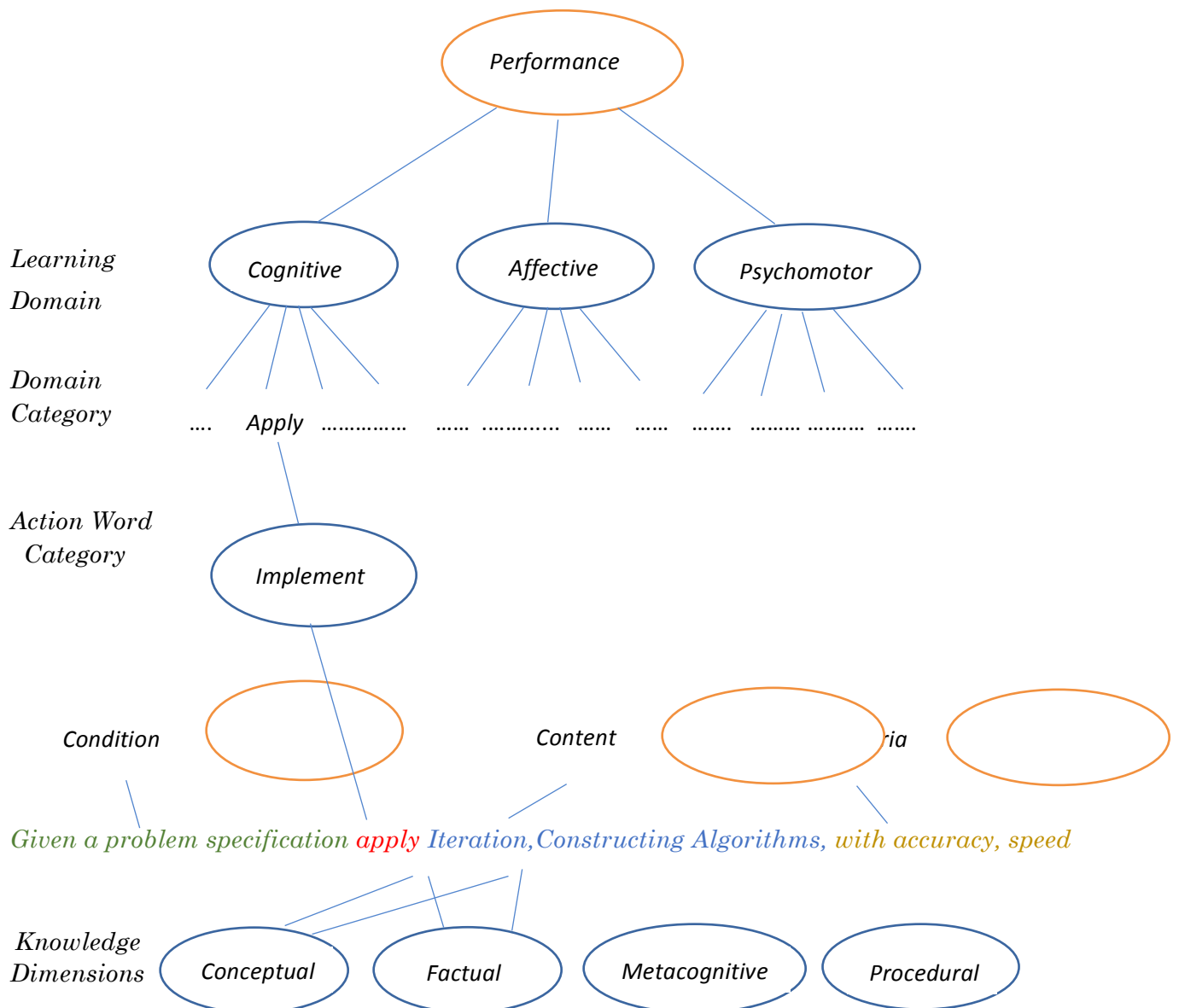


Figure 12 - Learning Objective Construction Flow Chart

## Content

There is a third sub-tab in the Learning Objectives tab that is labeled “Content”. Content can be defined in the content sub-tab (i.e. while defining the learning objectives) or it may be added in the Content tab. During content definition, the user identifies specific topics that will be covered in the course (i.e. the educational content). When adding topics, the user must identify the knowledge dimension (Factual, Conceptual, Procedural, or Metacognitive per Bloom’s Taxonomy) associated with each topic. Information on relevant resources (i.e. textbooks, websites, videos) can also be added to a topic. The user should also categorize the topic into one of the following three – Critical, Very Important, Good to know

**Given a problem specification, the student will be able to apply Constructing Algorithms, Constructing Formal Code, Iteration, Problem Solving, Selection, and Sequence with 85% accuracy and fine quality, quantity, and speed**

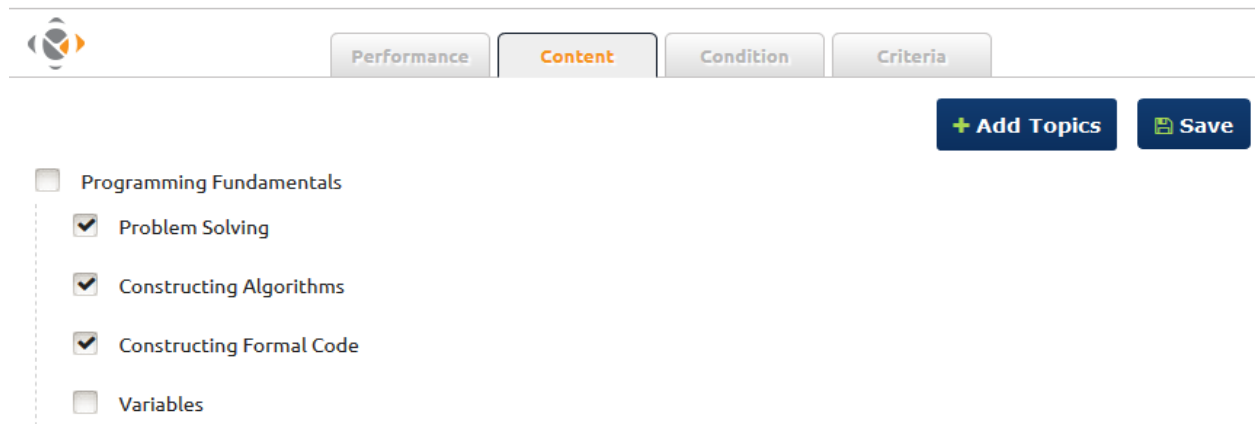


Figure 13 - Learning Objectives Content Tab

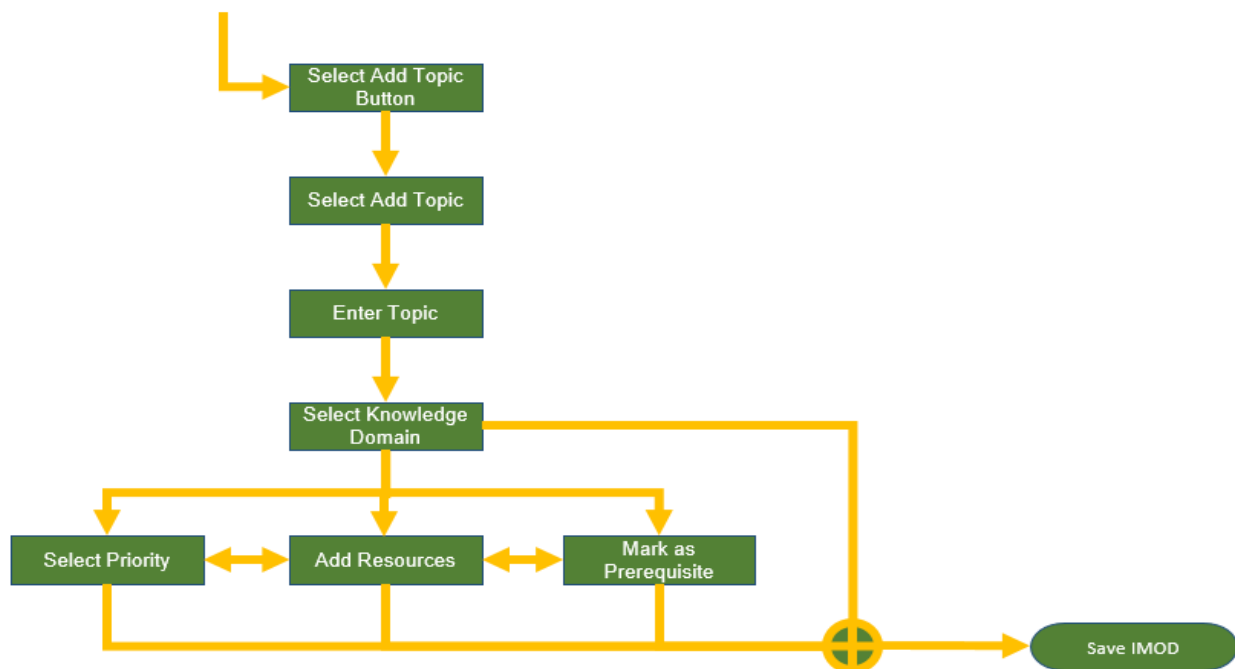


Figure 14 - Content Tab Flow Diagram

+ Add Topic		- Remove Topic		
<input type="checkbox"/> Topic	Knowledge Dimension	Priority	Resources	Pre-Req
<input type="checkbox"/> Java	<input type="checkbox"/> Knowledge Dimensions	Critical	Resources	<input type="checkbox"/>

Figure 15 - Learning Objectives Content Tab (Add Topic)

Course Overview	Learning Objectives	Content	Assessment	Pedagogy																																																																										
<input type="button" value="Save"/> <input type="button" value="Cancel"/>																																																																														
<b>Legend :</b> <input type="radio"/> Conceptual <input checked="" type="radio"/> Factual <input checked="" type="radio"/> Metacognitive <input checked="" type="radio"/> Procedural	<table border="1"> <thead> <tr> <th colspan="2">+ Add Topic</th> <th colspan="2">- Remove Topic</th> </tr> <tr> <th><input type="checkbox"/> Topic</th> <th>Knowledge Dimension</th> <th>Priority</th> <th>Resources</th> <th>Pre-Req</th> </tr> </thead> <tbody> <tr> <td><input type="checkbox"/> Programming Fun</td> <td><input type="checkbox"/> Knowledge Dimensions</td> <td>Critical</td> <td>Resources</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/> Problem Solving</td> <td><input type="checkbox"/> Knowledge Dimensions</td> <td>Critical</td> <td>Resources</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/> Constructing Algo</td> <td><input type="checkbox"/> Knowledge Dimensions</td> <td>Critical</td> <td>Resources</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/> Constructing For</td> <td><input type="checkbox"/> Knowledge Dimensions</td> <td>Critical</td> <td>Resources</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/> Variables</td> <td><input type="checkbox"/> Knowledge Dimensions</td> <td>Critical</td> <td>Resources</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/> Software Develop</td> <td><input type="checkbox"/> Knowledge Dimensions</td> <td>Critical</td> <td>Resources</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/> Setup And Config</td> <td><input type="checkbox"/> Knowledge Dimensions</td> <td>Critical</td> <td>Resources</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/> Writing Code</td> <td><input type="checkbox"/> Knowledge Dimensions</td> <td>Critical</td> <td>Resources</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/> Executing Code</td> <td><input type="checkbox"/> Knowledge Dimensions</td> <td>Critical</td> <td>Resources</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/> Errors (Syntax, S</td> <td><input type="checkbox"/> Knowledge Dimensions</td> <td>Critical</td> <td>Resources</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/> Program Structur</td> <td><input type="checkbox"/> Knowledge Dimensions</td> <td>Critical</td> <td>Resources</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/> Sequence</td> <td><input type="checkbox"/> Knowledge Dimensions</td> <td>Critical</td> <td>Resources</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/> Selection</td> <td><input type="checkbox"/> Knowledge Dimensions</td> <td>Critical</td> <td>Resources</td> <td><input checked="" type="checkbox"/></td> </tr> </tbody> </table>				+ Add Topic		- Remove Topic		<input type="checkbox"/> Topic	Knowledge Dimension	Priority	Resources	Pre-Req	<input type="checkbox"/> Programming Fun	<input type="checkbox"/> Knowledge Dimensions	Critical	Resources	<input checked="" type="checkbox"/>	<input type="checkbox"/> Problem Solving	<input type="checkbox"/> Knowledge Dimensions	Critical	Resources	<input checked="" type="checkbox"/>	<input type="checkbox"/> Constructing Algo	<input type="checkbox"/> Knowledge Dimensions	Critical	Resources	<input checked="" type="checkbox"/>	<input type="checkbox"/> Constructing For	<input type="checkbox"/> Knowledge Dimensions	Critical	Resources	<input checked="" type="checkbox"/>	<input type="checkbox"/> Variables	<input type="checkbox"/> Knowledge Dimensions	Critical	Resources	<input checked="" type="checkbox"/>	<input type="checkbox"/> Software Develop	<input type="checkbox"/> Knowledge Dimensions	Critical	Resources	<input checked="" type="checkbox"/>	<input type="checkbox"/> Setup And Config	<input type="checkbox"/> Knowledge Dimensions	Critical	Resources	<input checked="" type="checkbox"/>	<input type="checkbox"/> Writing Code	<input type="checkbox"/> Knowledge Dimensions	Critical	Resources	<input checked="" type="checkbox"/>	<input type="checkbox"/> Executing Code	<input type="checkbox"/> Knowledge Dimensions	Critical	Resources	<input checked="" type="checkbox"/>	<input type="checkbox"/> Errors (Syntax, S	<input type="checkbox"/> Knowledge Dimensions	Critical	Resources	<input checked="" type="checkbox"/>	<input type="checkbox"/> Program Structur	<input type="checkbox"/> Knowledge Dimensions	Critical	Resources	<input checked="" type="checkbox"/>	<input type="checkbox"/> Sequence	<input type="checkbox"/> Knowledge Dimensions	Critical	Resources	<input checked="" type="checkbox"/>	<input type="checkbox"/> Selection	<input type="checkbox"/> Knowledge Dimensions	Critical	Resources	<input checked="" type="checkbox"/>
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Figure 16 - Content

### Assessments and Pedagogy

The purpose of this tabs is to identify instructional techniques and to create an instructional plan. Once the learning objectives are defined, the user is able search the application's repository for an appropriate technique match for a learning objective based on the specified knowledge domain. If an acceptable match is found, the user can add the technique to the IMOD or clone and edit the technique. The user can also create his own technique if an appropriate match is not found. As mentioned previously, the technique search features can be used independently without requiring the user to proceed through the entire process of creating an IMOD.

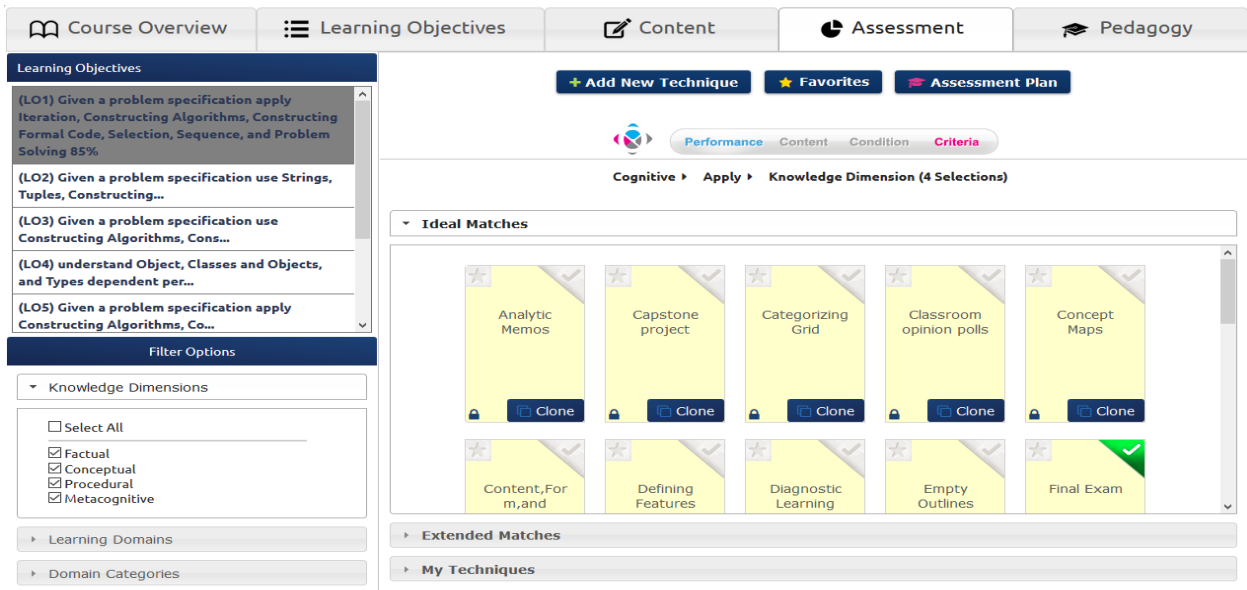


Figure 17 – Assessment Techniques

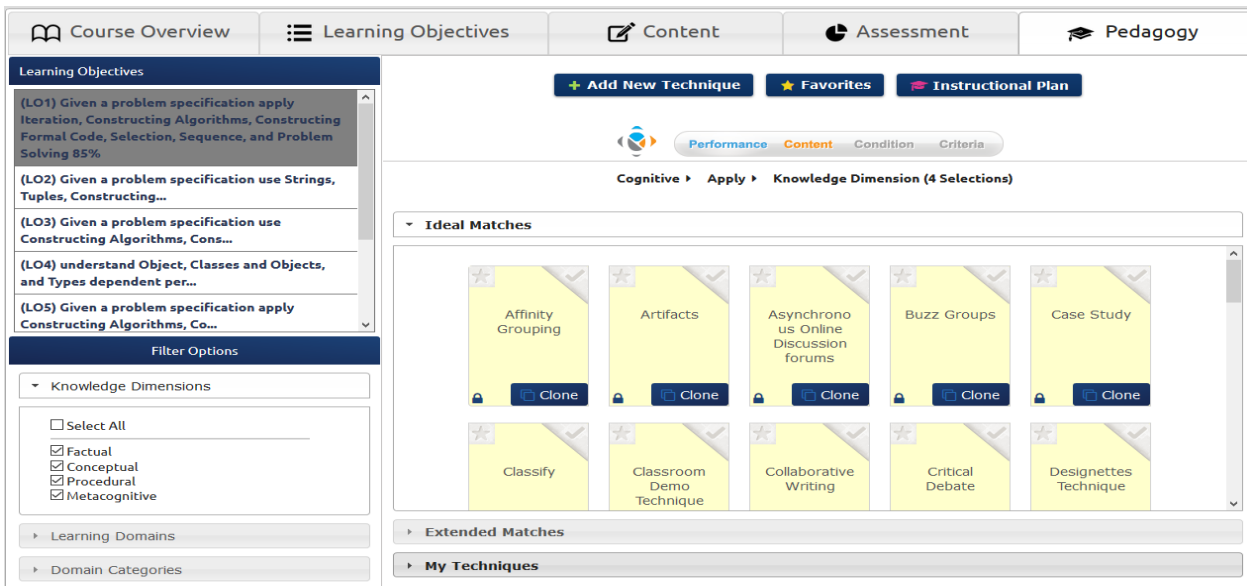


Figure 18 - Pedagogy Techniques

## Conclusion

*In the end, the IMODS tool generates three documents for use by the instructor and the students – the instructional plan from pedagogy, assessment plan from assessments tab and the syllabus from course overview tab. The instructor can choose what parts of these documents to share with students. The documents generated are well organized and provides the instructor a way to share the expectations and course plan with the students, who can then see if the course is a good fit for them.*