The ATE Suitability Inventory:

A tool for analyzing features of workforce education instructional materials

October 2010

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Executive Summary

Through the National Science Foundation's Advanced Technological Education (ATE) program, community college technician educators have created many useful course and curriculum materials to prepare the U.S. workforce for the jobs of the future. Despite efforts to foster dissemination of these materials, few community college educators know about these materials or how to find them. To address this problem, SRI International developed and tested a system for summarizing the key components of technician education instructional materials, their logistical requirements, and their learning objectives. The goal of this targeted research project was to provide community college classroom practitioners and online materials librarians with an easy-to-use and valid checklist for tagging instructional materials so other educators can find them better using search engines and digital libraries.

Such a tool is timely. In the next 10 years, 19 of the 30 fastest-growing occupations will require community college education in "middle skill" technical proficiencies. This training leads to jobs like veterinary technologist, physical therapist assistant, dental hygienist, and environmental science and protection technician. The push for increased partnership between private industry and community colleges will mean more educators will seek appropriate teaching materials quickly to launch new programs. The ATE program offers a potentially important resource: ready-to-use technical education instructional resources developed over more than a decade. Career and technical education (CTE) program administrators may use these materials to initiate training programs in newer high-skill fields. Developmental and transfer-track educators may use these materials to provide a real world context in which the principles of science, technology, engineering, and mathematics can be applied.

Designing the Suitability Inventory

This report documents the design and validation of a checklist intended to provide a consistent set of features that can be used to "tag" instructional materials so instructors can find and select them for their classrooms. We call it the Suitability Inventory since these features help instructors determine whether a particular set of instructional materials is suitable for an institution, program, or classroom. The inventory design was based on discussions with key ATE Center leaders who specialized in disseminating instructional materials online and conducting professional development to support CTE faculty. It was also based on a model of how post-secondary educators search and select instructional materials (Stark, Lowther, Ryan, & Genthon, 1988). This model includes three key elements of faculty decision-making in lesson design—context, content, and form.

Based on these initial ideas, the research team set forth the following four features for characterizing ATE instructional materials: institutional fit, technical quality, ease of use, and materials components. The inventory also includes information such as the date the materials were created and contact information for the authors.

Validation of the Suitability Inventory

To validate the inventory, two types of validity study were conducted. First, the research team compared the inventory to another scale that rates the quality of ATE instructional materials, the Technical Education Curriculum Assessment (TECA) (Keiser, Lawrenz, & Appleton, 2004). This validity study indicated the inventory was similar in content and focus to the "pedagogical soundness" subscale of the TECA. This subscale captures aspects of teaching technique, assessment, rigor of learning goals, and types of learning goals: general education content and professional skills. The validity findings indicate the Inventory captures some of the same aspects of instructional quality measured by TECA.

Second, the research team engaged an expert panel of ATE Center leaders and online librarians in using the inventory to characterize two exemplars of ATE course materials that contrasted in their explicit guidance to instructors on how to use the materials. This task showed that different raters could use the inventory reliably with minimal training.

The results of the two validity studies indicate that the Suitability Inventory provides a valid set of features to help CTE faculty find and select instructional materials that meet the needs of their classrooms, programs, and institutions. The inventory also provides a valid means of assessing the instructional quality of technician education instructional modules. Most of the subsections of the inventory are easy for professional educators and instructional materials librarians to use to provide an at-a-glance view of the distinguishing features of the instructional materials.

The study indicates that higher quality ATE materials provide good models for teaching professional skills to the technician workforce. The higher quality materials focus on teaching both technical content and professional skills, and provide clear guidance on teaching methods and rich materials for classroom use. Professional skills are those that go beyond narrow technical content knowledge and toward the skills of using technical knowledge to solve real world problems, work on teams, and communicate to diverse audiences. These learning outcomes align with the priorities of both the Secretary's Commission on Achieving Necessary Skills report (1991) and calls for better training of the technician workforce (Carnevale, Smith, & Strohl, 2010).

On the other hand, the study also pointed to some surprising shortcomings in many ATE instructional materials. Most ATE instructional materials narrowly emphasized technical knowledge and provided basic lists of required classroom materials—such as Internet access. Few ATE materials provided any guidance on teaching approach or expanded learning goals including professional skills and general education content. Few ATE materials in the sample mentioned alignment with industry standards. This gap might have been attributed to the sampling technique, which focused on single class modules. We hope that some of the modules were embedded in larger curriculum sequences that specifically cited industry standards. Nonetheless, given that many technician educators may seek to use only a single ATE module in their classrooms, it would be helpful to specify the industry standards addressed within each module.

There have been perceptions within the ATE program that instructional materials design may not be the best use of funds, given that, once created, other practitioners infrequently adopt the ATE materials. Yet the findings from this report provide a more nuanced picture of the accomplishment of ATE program's instructional materials designers.

Some ATE designers are producing high-quality materials that point the way to a future when a technical workforce is endowed with not just technical expertise, but a high degree of professionalism.

Most of the ATE designers, however, could use some guidance on how to get their instructional materials closer to this standard. This study shows the starting point:

- Provide a blend of technical and professional learning goals.
- Emphasize how traditional academic knowledge from science, technology, engineering, and mathematics can be learned through the materials.
- Provide more information on how to teach with the materials and include more usable materials for the classroom materials—from instructor guides to assessments.
- Provide clear indicators of how the materials align with industry standards

The Suitability Inventory Design

Technician education instructors need efficient ways to find materials that help them prepare future technicians for the high-skill workforce. To date, little research exists that describes the way technician educators select and integrate course materials into their classrooms. Our literature review identified one article addressing this process. Stark and colleagues (1988) framed college course planning as a decision-making process in which “instructors select content to be taught, consider various factors affecting teaching and learning process, and choose from among alternative strategies for engaging students with the content” (p. 221) (See Appendix A). Based on prior research, Stark and colleagues hypothesized that college faculty plan courses based on their own discipline-embedded assumptions and beliefs, socialization into their fields, and awareness of lesson design that focuses on concerns about context, content, and form (Toombs, 1977-78). They interviewed 89 faculty members who taught introductory courses in different disciplines, including two applied courses—business and nursing. Their protocol focused on how much instructional content, context, and form influenced faculty members’ decisions about materials selection. The faculty members reported that the primary influence on their lesson design was content, but they also modestly considered contextual concerns such as departmental priorities and initiatives. They only minimally considered instructional forms, which focus on different ways of organizing classroom activities and presenting information, as a selection criterion.

Although the earliest vocational programs sprang from the need to prepare more blue-collar students with practical skills for the nation's farms, factories, and homes, the new economy demands more from technicians (Lynch, 2000). Learning technical knowledge and procedures is just one component in the updated expectations for technician learning. Technicians are also expected to learn skills of technical problem solving, lifelong learning, collaboration, and flexible use of technology. Both national standards and research in career and technical education underscore the shift away from a narrow focus on transmitting content knowledge to a broader instructional focus on preparing students to solve problems, learn continuously, and adapt to the culture of workplace (National Board for Professional Teaching Standards, 1997; Yarnall & Ostrander, pending). These expectations suggest that the decisions CTE faculty need to make when selecting materials will include a greater emphasis on contextual concerns about institutional and local industry priorities and consciousness about how to use different instructional forms to teach professional skills of teamwork, communication, and problem solving.

Based on these considerations, the inventory needed to address the full range of possible considerations that CTE faculty may use in selecting classroom materials. To design the elements of the checklist, researchers iteratively developed a checklist of components relevant to technician educators under each of the core Toombs’ categories of consideration: context, content, and form.

ATE Center leaders were consulted in revising and focusing this checklist. The inventory contains a total of 58 features or components that are relevant to technician education materials. The features and components are grouped under the following four dimensions:

1. *Institutional Fit*, which contains 20 features grouped into three categories that address contextual considerations, including those relating to institutionally required curriculum content: (a) relevance to special types of students; (b) academic content learning goals relating to science, mathematics, computer science, and other disciplines, and (c) industry learning goals such as tool use and professional skills.
2. *Instructional Technical Quality*, which contains 14 features grouped into two categories focused on considerations of content and content-driven forms: (a) instructional delivery modes and (b) industry standards alignment.
3. *Ease of Use*, which contains 10 features grouped into three categories relating to forms of instructional delivery: (a) required instructor background knowledge or experience; (b) teaching tips; and, (c) classroom materials required.
4. *Instructional Materials Components*, a section that contains 14 components characterizing the forms of the instructional materials, such as instructor guides, student activity materials, and assessments.

Two types of items were used to classify the features of interest. In the first type of item, the rater checks if the features are cited or not (dichotomous categorical items). In the second type of item, the rater indicates if the features are explicitly stated, only implied, or not clear (3-level categorical items). The revised instrument appears in Appendix B. Figure 1 shows the item type breakdown:

Figure 1. Item Types in the Suitability Inventory by Four Dimensions

Suitability item dimensions	**Total # of items**	**# 2-level categorical items (Cited, Not Cited)**	**# 3-level categorical items (Stated, Implied, Not Clear**	**Total # features across all items**
Institutional Fit	3	1	2	20
Technical Quality	2	1	1	14
Ease of Use	3	2	1	10
Components	1	1	0	14
	9	5	4	58

Validity Study 1: Comparing the Suitability Inventory to TECA

To test the validity of the Suitability Inventory, the research team conducted an inter-rater reliability study and several sub-studies examining the inventory's correspondence with an existing instrument measuring the quality of ATE instructional materials, the Technical Education Curriculum Assessment (TECA) (Keiser, Lawrenz, & Appleton, 2004). This section of the report describes the TECA, its use in this study, the inter-rater reliability results for using the TECA and the Suitability Inventory, and the sub-studies validating the correspondences between TECA and the Suitability Inventory. It also compares the features of high-rated and low-rated technician education materials.

TECA Background

Researchers developed the TECA as a tool for improving the quality of technician education. TECA identifies the indicators of quality in technician education instructional materials and provides a rating scheme of those indicators. The TECA draws from three sources: The SCANS skills for career and technical education (Secretary's Commission on Achieving Necessary Skills, 1991), CTE curriculum development theory (Finch & Crunkilton, 1999), and a model for assessment and curriculum development (Wiggins, 1993, 1998).

Based on these sources, the TECA design team developed a theoretical framework for the TECA that focuses on the following indicators: Responsive Educational Experiences, indicators that provide evidence that the instruction puts the student at the center of lesson design; Deep Understanding, indicators that describe curriculum that promotes deep understanding of content and meaning; and Relationship to Work, indicators that characterize curricula that are oriented to, and justified by, workplace demands.

The TECA contains three sets of rubric questions focused on technical value, pedagogical soundness, and a holistic rating simultaneously focused on technical and pedagogical qualities. In addition, there is one final summary rating of the effectiveness of the instructional materials. The first rubric is composed of five items that are answered by industry experts about the alignment of materials with the workplace, application of knowledge, use of technology, rigorous content and quality performance. The second rubric is composed of six items that are answered by experts in curriculum, instruction and assessment about instructional strategies, problem solving, general education, assessment, personal qualities, and diversity. Each of these contains a series of priming prompts (yes/no) to focus raters on specific quality indicators in instructional materials. For example, a priming indicator relating to collaborative instruction is: "Do the materials require students to coordinate their efforts with others? Yes or No." Several of these priming prompts are followed by a holistic Likert scale (0-4) asking for a rating on the specific indicator of instructional quality. The third rubric is composed of four items that are answered by both industry and curriculum specialists and focused on holistic ratings of both technical and pedagogical aspects of the materials. The fourth rubric contains one question seeking an overall rating of materials. Tests of reliability indicated that scorer ratings were in exact agreement exactly 50% of the time and were within 1 point of agreement 90% of the time. Internal consistency between ratings on the first three rubrics and the final rubric was .90 and internal consistency between the final two rubrics was .77.

TECA Scoring Preparation: The team used only TECA's pedagogical quality subscale for correspondence analysis since it focused on features similar to those identified in the Suitability Inventory. The TECA instruction subscale examines the following quality indicators:

1. *Rigorous Content,* which relates to applying rigorous understanding of mathematics, science, and technological concepts
2. *Quality Performance*, which relates to clear guidelines for assessment
3. *Instructional Strategies*, which relates to instructional elements focused on applied learning
4. *Problem Solving*, which relates to instructional opportunities for students to work with complex problems
5. *Integration of General Education Content*, which relates to instruction that integrates general reasoning skills
6. *Personal Qualities*, which relates to instruction that develops students teamwork and project management skills
7. *Diversity*, which relates to the features of the instruction that foster understanding of diverse populations and work settings

The research team developed a set of decision rules for how to apply the TECA. Both the TECA rubrics and the team's decisions about how to apply the TECA to instructional materials appear in Appendices D and E. For the purposes of the correspondence study, the team removed Rigorous Content and Diversity from the rating procedures because neither of these aspects of the TECA was expected to correspond with the Suitability Inventory.

Methodology

Sample: SRI International gathered 43 instructional modules from ATE projects and centers in the fields of information technology (23 modules) (IT) and manufacturing/engineering (20 modules) (See Appendix C for list). Due to time constraints, modules selected for scoring focused on single lessons or units rather than full course curricula. They varied in length from a 5-page PowerPoint to materials numbering more than 100 to 200 pages in length. The materials varied in instructional modes and presentation media. Of the materials gathered, 41 modules (22 IT, 20 manufacturing) were coded using the TECA and the Suitability Inventory. On average, it took approximately 8 minutes to rate a set of materials with TECA and took approximately 13 minutes to document the features of a set of materials using the Suitability Inventory (See Appendix F).

Procedures: An in-house team of 6 educational researchers conducted a scale preparation phase, developing decision rules for coding instructional materials using each instrument.

Inter-rater Agreement: Two different pairs of raters scored the same set of instructional materials: One set of raters used the TECA and the other set of raters used the Suitability Inventory. This approach was used to preserve independence of ratings.

The TECA scoring team used 12 modules (6 IT, 6 manufacturing) for rubric training. Then the TECA team conducted *two rounds* of scoring with subsets of 8 modules (4 IT, 4 manufacturing/engineering per round), for a total of 16 modules across both rounds. The first round of scoring achieved 100% agreement on Quality, Instructional Strategies, and Personal Qualities, but failed to achieve at least 75% agreement for Problem Solving and General Education. The second round of scoring achieved 100% agreement on Quality, General Education, and Personal Qualities; 87.5% agreement on Instructional Strategies; and 75% agreement on Problem Solving. Then, one team member scored the remaining 13 modules (6 manufacturing, 7 IT) independently.

The Suitability team used 4 modules (2 IT, 2 manufacturing) for rubric training. The Suitability team conducted one round of reliability scoring with 8 modules (4 IT, 4 manufacturing/engineering) and achieved 80% agreement across all the items. Then, one Suitability team member scored the remaining 15 IT modules independently and the other team member scored the remaining 14 manufacturing modules independently.

Analysis and Findings

The research team provided confidentiality to all ATE project and centers that provided materials for this validation study.

The mean score across all 41 sets of materials on TECA out of a maximum possible score of 20 was 5.88 with a standard deviation of 4.77. The distribution was skewed positively, with more of the materials scoring at the mean or lower. The maximum score was 17 and the lowest score was 0.

The Suitability Inventory serves as a tally system, totaling the number of features that are present within the instructional materials. The maximum tally counted was 29 features out of a possible 58. The minimum tally counted was 5 features.

Correspondence Analysis

To examine the correspondence in ratings between the two instruments, researchers compared the rank order of the materials according to the TECA quality ratings and the numbers of Suitability Inventory features. The distribution of materials rank ordered under TECA was sorted into a standardized distribution, with cut scores assigned for each standardized deviation above or below the mean TECA score.

The following distribution emerged: Three sets of ATE instructional materials were rated on the TECA quality scale with scores greater than two standardized deviations above the mean. Six sets of materials were rated greater than one standardized deviation above the mean. Twelve sets of materials were ranked within one standardized deviation above the mean. Twelve sets of materials were ranked within one standardized deviation below the mean. Eight sets of materials were ranked greater than 1 standard deviation below the mean.

After sorting the materials according to standardized TECA scores, the correspondence to the Suitability Inventory was examined by comparing the mean number of Inventory features checked for the collection of materials within each single segment of the standardized distribution. Patterns were reviewed. There was an overall trend that the materials sorted into higher ranks on the standardized distribution contained more mean mentions of Inventory features than materials rated lower on TECA. The results appear in Figure 2.

Figure 2. Instructional Materials' Mean Number of Suitability Features Sorted by TECA Quality Scores

TECA Cut point Subset (M)	Number of Materials in Subset (N)	Institutional Fit Academic Learning Goals (M)	Institutional Fit Industry Learning Goals (M)	Technical Quality Instructional Mode	Technical Quality Industry Standards (M)	Ease of Use Instructor Knowledge (M)	Ease of Use Instructional Tips (M)	Ease of Use Required Materials (M)	Support Components Included (M)	Overall Suitability Features (M)
>15.32	3	2.66	3.00	3.66	0.66	3.00	0.66	2.33	2.38	2.29
15.32-10.55	6	1.16	3.00	3.66	0.16	1.33	0.66	2.83	2.00	1.85
10.55-5.88	12	0.91	1.25	2.16	0	0.91	0.16	2.25	0.91	1.07
5.88-1.11	12	2.08	1.25	1.25	.08	1.25	0.42	2.66	0.75	1.22
<1.11	8	0.65	0.75	1.63	0	1.38	0.13	2.13	0.38	0.88

The results indicated that most materials, whether highly rated or low rated, mentioned the required materials needed for instruction. Few of the materials, whether highly rated or low rated, mentioned industry standards or provided teaching tips on how to use the materials.

Highly rated materials contained more explicit descriptions of instructional mode and the level of instructor knowledge required for teaching the module. The highest rated materials on TECA had the most descriptions of academic learning goals, industry standards, teaching tips, and components. The lower-rated materials on TECA had more descriptions of industry learning goals and the materials required for teaching.

Alignment analysis: To understand the correspondences between the two instruments, a researcher reviewed the TECA and Suitability Inventory and laid out a logical analysis for which TECA items related to specific Suitability features. Possible areas of correspondence are listed in Appendix G.

This analysis indicated that both TECA and the Suitability Inventory corresponded around particular quality indicators of instructional materials: clear guidelines for assessment, descriptions of teaching approaches to meet different student needs, and opportunities to learn problem solving, teamwork, and communication.

Suitability Inventory Features that Help Instructors

An operating hypothesis of the Suitability Inventory is that instructional materials require some degree of clear "operating instructions" to help prospective instructors adopt them and integrate them into their classrooms. Based on this logic, the research team expected to see variation between the highly rated materials and low-rated TECA materials in the level of explicit guidelines provided to instructors.

To test this hypothesis, researchers analyzed the Suitability Inventory ratings of how explicitly or implicitly the instructional materials addressed the specific instructional features. This analysis focused on the four sets of 3-level items that differentiated between materials that explicitly mentioned or only implied the following features: academic and industry learning goals (Institutional Fit), instructional approaches (Instructional Technical Quality), and materials needed (Ease of Use).

The level of inference required for raters to determine these features was computed by dividing the total number of implicit features of a set of materials by the total number of explicitly mentioned features of a set of materials. There was, on average, slightly more than twice as much inference required to determine the features of low-rated TECA materials as high-rated TECA materials on three of the four dimensions. The findings indicated that the higher rated materials provided much more information about instructional mode, required resources, and academic learning goals. By contrast, all materials contained similar levels of explicit listings of industry specific learning goals. The results appear in Figure 3, with lower levels of inference signifying stronger guidance to instructors.

Figure 3. Percentage of Inference Required For Determining Key Instructional Aspects of High and Low Rated TECA Materials

TECA Cut point Subset (M)	Institutional Fit Academic Learning Goals (%)	Institutional Fit Industry Learning Goals (%)	Technical Quality Instructional Mode (%)	Ease of Use Required Resources (%)	Overall Inference Level (%)
>15.32	0.13	0.44	0.09	0.28	0.24
15.32-10.55	0.43	0.22	0.27	0.47	0.35
10.55-5.88	0.18	0.33	0.30	0.52	0.33
5.88-1.11	0.60	0.40	1.00	0.57	0.64
<1.11	0.50	0.33	0.85	0.64	0.58

Suitability Features Aligned with Technician Education Reform Goals Research has indicated that technician education will be improved by moving beyond teaching only technical content and procedures and toward rigorous instructional modes that teach problem solving and professional skills. Based on this logic, the research team expected to see that higher rated materials would contain more of these features on the Suitability Inventory than lower rated materials. Conversely, researchers would expect to see little difference between the higher rated and lower rated materials in more traditional forms of instruction, such as lecture and textbooks.

Analysts compared the highest and the lowest rated TECA materials by number of reform-oriented inventory features only. These features included professional skills such as teamwork, communication, and project management and hands-on instruction and teamwork. The researchers also compared, for contrasting purposes, the contrasting materials on the features of lecture or text reading. The Suitability Inventory also contained features that noted whether instructional professional development was mentioned or recommended in the materials--but there were too few data to compare.

The higher rated TECA materials did include more mentions in the Suitability Inventory of “professional skills” as learning goals and more emphasis on hands-on and teamwork activities. There was little difference between them in the rates at which they mentioned lecture or text reading. The results from this comparison focused on the two reform-oriented instruction inventory features (professional skills learning goals; collaborative and hands-on instruction) and the one traditional instruction inventory feature (lecture or text reading) are in Figure 4.

Figure 4. Comparison of Mean Number of Features of Effective Technician Education Instruction between High and Low Rated TECA Materials

TECA Cut point Subset (M)	Institutional Fit Industry Learning Goals: Professional Skills (M)	Instructional Technical Quality Instructional Mode: Lecture or Text Reading (M)	Instructional Technical Quality Instructional Mode: Hands-On or Teamwork (M)
>15.32	2.66	1.66	2.00
<1.11	0.28	1.87	0.75

Validity Study 2: The Expert Panel

To get a sense of the usability and reliability of the Suitability Inventory under conditions of regular usage, the research team convened a panel of four experts. In the design of instruments used to classify or rate features of instruction, expert panels are employed to provide judgments about content validity. Experts rate the various items, and if they are in consensus, then inferences may be made about the validity of the instrument.

For the Suitability Inventory, we wanted evidence that the instrument could be used to classify the features of technician education instructional materials accurately and with little training. The expert panel was designed to provide some evidence that they could use the instrument in that fashion. In addition, the expert panel was to provide some feedback about the relevance and utility of the instructional features of the Suitability Inventory for three audiences: faculty members who have designed materials, faculty members who seek to use the materials, and librarians who seek to align these materials with meta-tags used to codify their digital collections.

Methodology

The experts for the panel were selected for their experience with online libraries of technician education and general education materials, online instructional materials dissemination, and faculty professional development for technician educators. The panel was comprised of two online instructional materials librarians and two experienced ATE Center leaders.

The expert panel was conducted online via a webinar. A few days before the webinar, expert panelists received a packet featuring two selected exemplars of ATE instructional materials. To address possible bias among the panelists, the authors and institutions responsible for these materials were not revealed and all identifying references were removed. The selected materials represented contrasting exemplars, one representing an example of materials with a high number of Suitability Inventory features and the other representing an example of materials with a low number of features. Efforts were made to keep the raters blind to condition.

In preparation for the expert panel, the panelists were instructed to read through the materials and prompted to reflect on the key features of the Suitability Inventory:

- Do the materials indicate the students best served by the materials? *For example, special education, English language learners, adult career transition, beginning students, advanced students.*
- Do these materials articulate academic learning goals and include content in the areas of science, math, and/or computer science?
- Do these materials articulate industry-learning goals and include content in the areas of tool/technology use, specialized computational procedures or professional qualities?
- What instructional delivery mode is suggested for engaging students?
- What industry standards or DACUM review processes are cited?
- To conduct the lesson, what background knowledge or training is suggested for instructors?
- Do the materials offer explicit suggestions and/or tips for how to successfully present the content to the students? *For example, offering discussion prompts for class discussion, providing open–ended questioning strategies, and guides on how to run student teams.*
- To conduct the lesson, what required classroom materials are suggested?
- What curriculum components are included in the materials?
- What assessment components are included in the materials?

The expert panel webinar was conducted in August 2010 over 3 hours. There was a 15-minute introduction to the online version of the Suitability Inventory that panelists would use to rate the materials.

The panelists used the Suitability Inventory to classify one set of materials and then the other set. While the panelists filled out the inventory, the research team tracked the emerging levels of agreement online.

Following each of the two classification sessions, researchers discussed items with lower levels of agreement to understand the factors leading to differences among the panelists. At the close of the session, there was an overall discussion about the utility of the Suitability Inventory.

Analysis and findings

The data were exported into spreadsheet software. They were reviewed for accuracy.

There was some variation found in the number of panelists who completed the possible 58 distinct items. Items were removed from computations of inter-rater agreement for each exemplar that were not completed by all 4 panelists. In these cases, only 3 or 2 panelists completed these items, apparently because of the press of time in the fixed 3-hour online coding period and the fact that, in the case of Exemplar 2, some panelists began “skipping” items that did not apply to the materials. Because of these gaps, analysts removed 9 items for Exemplar 1 (15%) and 18 items for Exemplar 2 (31%). Most of the missing items in Exemplar 1 were in the Ease of Use category. The missing items in Exemplar 2 were in both the Technical Quality and Ease of Use categories.

There was also variation in consistency of item coding by the panelists and the SRI in-house coders (from the first validity study). Items not coded by the SRI in-house coder were removed from computations of inter-rater agreement for each exemplar. Analysts removed 14 items for Exemplar 1 (24%) and 11 items for Exemplar 2 (19%). The difference largely focused on two items that were added after the initial validity study (beginner and advanced students) and most of the components items, which the in-house SRI coder had not coded.

Overall Panel Agreement. On the dichotomous features (cited/not cited), coders agreed 95% of the time. On the three-level features (state/implied/not clear), coders agreed exactly 81% of the time and agreed within 1 point 99% of the time.

Overall Panel and SRI Coder Agreement. The panelists reached 100% agreement with the SRI Coder 91% of the time for Exemplar 1 and 85% of the time for Exemplar 2.

Features for Exemplar Materials. The findings indicated that both the panelists and the SRI coder could use the Suitability Inventory to distinguish between the number of features included in each set of exemplar materials. The coding showed what features were present in the higher quality and lower quality materials. The overview of features for each set of materials is provided in Figure 5. As can be seen, five features of the Suitability Inventory distinguished high-quality from low-quality ATE Technician Education materials provided information about the professional skills that could be learned, the instructional approach to be employed, tips or guidelines about instructor training, knowledge, or teaching tips, classroom materials needed, and components such as instructor guides, student materials, and assessments.

Figure 5. Comparative Overview of Instructional Material Features between High- and Low-quality ATE Technician Education Instructional Materials

Inventory Subsection/Element	Exemplar 1 Higher quality	Exemplar 2 Lower quality	Number of Items	Quality-Distinguishing Feature?
Institutional Fit				
Student Fit (Special education, ELL, adults, beginners, advanced)	NA	NA	5	N
Academic Subject Alignment (Sciences, mathematics, computer science)	Implied or NA	Implied or NA	10	N
Professional Skills Alignment (Teamwork, Project management, etc.)	Usually stated	Usually NA	5	Y
Technical Quality				
Instructional approach	Usually stated	NA	7	Y
Industry standards alignment	NA	NA	7	N
Ease of Use				
Instructor background, training, & tips	Usually implied	NA	5	Y
Materials needed	Usually stated	NA	5	Y
Components (Instructor Guides, Student Materials, Assessments, etc.)	Usually included, except for assessments	NA	14	Y
TOTAL			58	

To see which subsections of the Suitability Inventory were most usable to panelists, analysts also reviewed the percentage of the time that panelists reached 75% agreement for each of the Inventory's four subsections. As mentioned above, for three subsections, the drop-off in consistency of coding among panelists due to time constraints provided too few items to support computation of agreement. The findings appear in Figure 6.

Figure 6. Panel Agreement at 75% Level for Suitability Inventory Subsections

Inventory Subsection	Exemplar 1	Exemplar 2	Number of Items
Institutional Fit	.75	.75	20
Technical Quality	.85	*NA*	14
Ease of Use	*NA*	*NA*	10
Components	.78	.92	14
TOTAL			58

Panelists' Qualitative Feedback. The panelists said that most of the categories made sense and were easy to use, but they expressed doubt that most practitioners understood the value of using such a coding scheme for the instructional materials they design. In particular, panelists familiar with ATE technician education materials noted that most of them lack many of the features in the Suitability Inventory. Two of the three ATE panelists said that many, if not most, of the materials they had reviewed resembled Exemplar 2. Finally, the panelists wanted to know which of the features would be most important to include—since 58 is too many. One of the experts recommended trying to strike a balance between a really detailed inventory that provides the rich information for librarians and a very brief inventory that is more likely to be completed in full but is not very informative for meta-tagging.

Conclusion

Overall, these results of the two validity studies indicate that the Suitability Inventory might provide a valid, if indirect, means of assessing the instructional quality of ATE technician education instructional modules. Most of the subsections of the Inventory are easy for professional educators and instructional materials librarians to use to provide an at-a-glance view of the distinguishing features of the instructional materials.

The study indicates that higher quality ATE materials provide good models for teaching professional skills to workforce technicians. The higher quality materials focus on teaching both technical and professional skills and provide clear guidance on teaching methods and rich materials for classroom use. Professional skills are those that go beyond narrow technical content knowledge and toward the skills of using technical knowledge to solve real world problems, work on teams, and communicate to diverse audiences. These learning outcomes align with the priorities of both the Secretary's Commission on Achieving Necessary Skills report (1991) and calls for better training of the technician workforce (Carnevale, Smith, & Strohl, 2010). This study indicates that the best of the ATE instructional materials may provide models for how to teach such skills.

On the other hand, the study also pointed to some surprising shortcomings in many ATE instructional materials. Most ATE instructional materials narrowly emphasized technical knowledge and listed only a few required materials—such as Internet access. Few ATE materials provided any guidance on teaching approach or expanded learning goals including professional skills and general education content. Few ATE materials in the sample mentioned alignment with industry standards. This gap might have been attributed to the sampling technique, which focused on single class modules. We hope that some of the modules were embedded in larger curriculum sequences that specifically cited industry standards. Nonetheless, given that many technician educators may seek to use only a single ATE module in their classrooms, it would be helpful to specify the industry standards addressed within each module.

The ATE program has long provided support for community college technician educators to design instructional materials. This study indicates that the design of instructional materials carries with it some additional demands that may go beyond the expertise of some of the best technician educators. Materials design ultimately depends on thinking about the diverse audience of educators who may use these materials. As the underlying framework for the Suitability Inventory shows, there are a broad number of influences that contribute to an instructor's choices on classroom materials—disciplinary, institutional, and classroom-based. Past research indicated that many postsecondary instructors, particularly those from academic fields, are largely influenced by the priorities of their own disciplines. This study suggests that, in a similar way, technical educators focus mostly on the technical aspects of their fields. At the same time, this study showed that this narrow focus fails to meet the higher training standards sought by both policy makers and industry for the American technical workforce.

There have been perceptions within the ATE program that instructional materials design may not be the best use of funds, given that, once created, other practitioners infrequently adopt the ATE materials. Yet the findings from this report provide a more nuanced picture of the accomplishment of ATE's instructional materials designers. Some of them are producing high-quality materials that point the way to a future when a technical workforce is endowed with not just technical expertise, but a high degree of professionalism. Most of the ATE designers, however, could use some guidance on how to get their instructional materials closer to this standard. This study shows the starting point. At minimum, ATE instructional designers should provide a blend of technical and professional learning goals. They should show alignment to industry standards in every module. Where possible, ATE designers may also want to emphasize how traditional academic knowledge from science, technology, engineering, and mathematics can be learned through their materials. Both high-quality and low-quality ATE materials currently lack such specificity—but if more had it, other educators could use these materials to put academic knowledge into a motivating and applied context. The second key requirement for improving ATE instructional design involves providing more information on how to teach with the materials and a larger dose of classroom materials—such as instructor guides and student materials. One area representing a notable gap is assessment. Few of the high-quality or low-quality ATE materials provided assessments with their materials.

It remains to be seen how many of the features from the Suitability Inventory would be most important for educators to use in online searches for materials. For the purposes of this study, the research team cast a wide net for possible features of quality of instructional materials. Future study can help refine this list for practical use by online librarians of technician education materials and the educators who design the materials. What features are most critical to helping technician educators locate the precise materials they need to meet the particular needs of their institutions, students, classrooms, and local industry partners? As partnerships between industry and community colleges proliferate, practitioners will need efficient ways to find materials that meet specific industry standards and teach specific technical and professional skills.

Acknowledgements. This study was funded through a project called Discovering the Educational Consequences of Advanced Technology Education (DECA), DUE 0832874, a collaborative effort among seven institutions to conduct nine different research studies. The author wishes to thank the team members who assisted in this study: Geneva Haertel, Liliana Ructtinger, Aasha Joshi, Amy Hafter, Bowyee Gong, David Sherer, and Gabe Novais. The author also wishes to thank experts Manjari Wijenaike, Steve Wendel, Ruth Rominger, and Rachael Bower.

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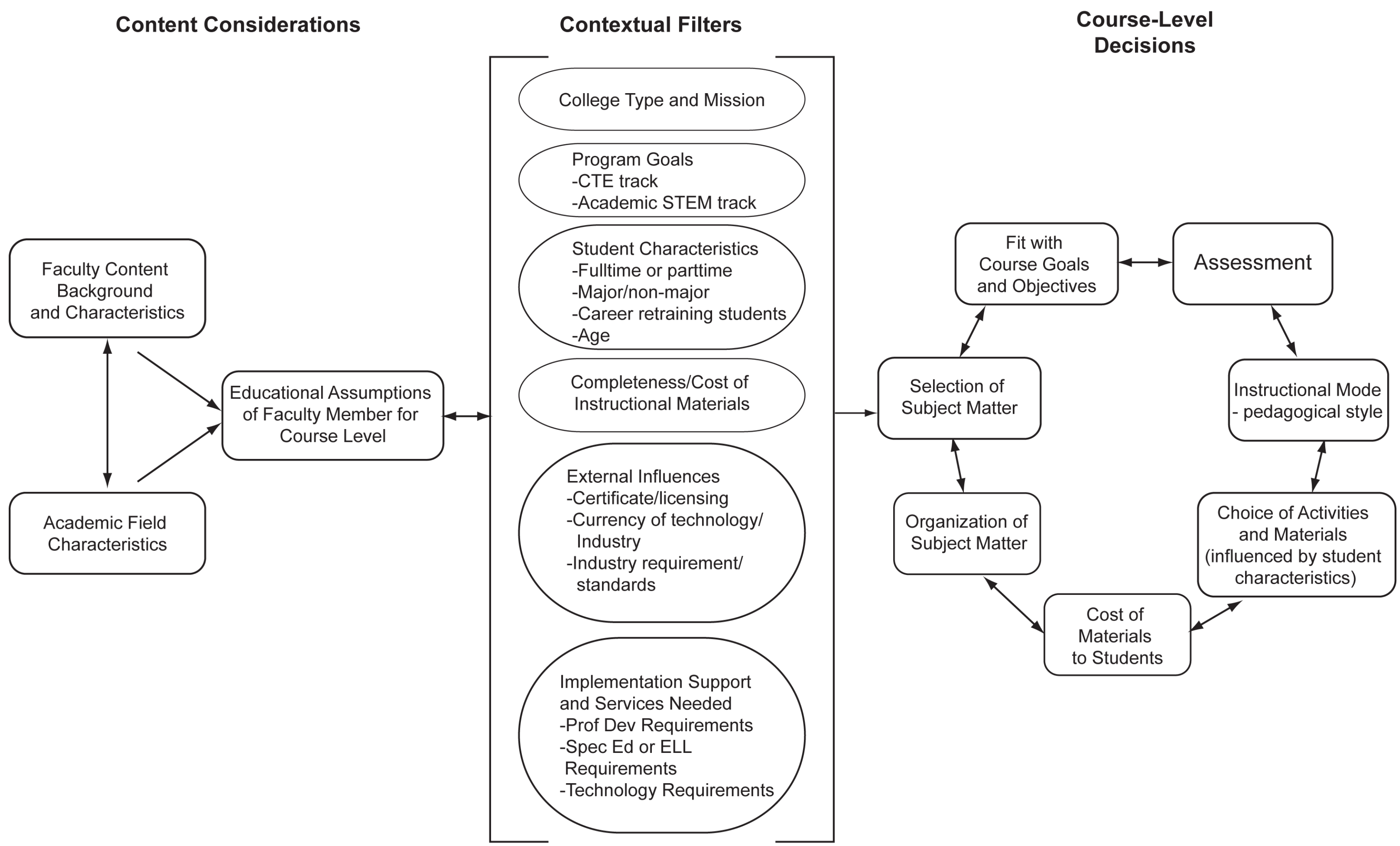
Appendix A. Influences on Instructor’s Decision Making on Curriculum



Appendix B. Suitability Checklist

ATE Materials Program Suitability Inventory

Name of Materials:____

Relevant Technical Field:

☐ IT ☐Manufacturing

Content Area(s):

____

Check one:

☐Curriculum Program with Multiple Installments

☐Independent Classroom Module

Kind of Activity:

☐Class Lecture

☐ Self-guided Reading

☐Self-guided Lab or Project/Problem or Hands-on Activity

☐ Team-based or Work Simulation

Student Learning Goals

____

Supplies Needed

____

Instructor Knowledge Needed

____

Target Students

____

Length of Activity

____

Industry Standards Addressed

Author(s):____

Author Contact Information:

Phone: ________________________________

Email: ________________________________ Website: ______________________________

1. INSTITUTIONAL FIT INVENTORY

1.1 Do the materials indicate the students best served by the materials?

	Materials DO explicitly mention they are intended for these students	Materials DO NOT explicitly mention that they are intended for these students
Special Education		
English Language Learner		
Adult Career Transition		
Beginning Students		
Advanced Students		

1.2 Do these materials articulate academic learning goals and include content in these areas?

	Learning goal articulated AND materials DO include content	Learning goal NOT articulated BUT materials DO include content	Learning goal NOT articulated AND materials DO NOT include content
Science Content			
Physics			
Chemistry			
Biology			
Math Content			
Basic arithmetic, subtraction, multiplication, division			
Algebra, geometry, trigonometry, calculus			
Statistics, probability			
Accounting, bookkeeping			
Computer Science Content			
Programming Theory			
Networking Theory			
Other Discipline Please describe:			

1.3 Do these materials articulate industry-learning goals and include content in these areas?

	Learning goal articulated AND materials DO include content	Learning goal NOT articulated BUT materials DO include content	Learning goal NOT articulated AND materials DO NOT include content
Tool or Technology Use, or Specialized Computational Procedures Please describe:			
Professional Qualities			
Problem solving			
Communication and Presentation			
Teamwork			
Project management			

2. TECHNICAL QUALITY INVENTORY

2.1 What instructional delivery mode is suggested by the materials for engaging students?

	Materials STATE this instructional delivery format	Materials IMPLY this instructional delivery format	Instructional delivery mode NOT CLEAR
Lecture or Online Self-Guided Overview			
Text Reading (Print or Online)			
Hands-on Activity			
Problem-based Activity			
Student Teams (Working in groups)			
Workplace Simulation			
Other Please describe:			

2.2What industry standards or review processes are cited in the materials?

	Materials cite industry standard or review process	Materials do NOT cite industry standard or review process
Established Fields		
ABET standards Please list standards:		
Other recognized accreditation standards Please describe:		
Licensure standards Please describe:		
Certification standards Please describe:		
Industry skill standards Please describe:		
Emerging Fields		
DACUM process or other formal industry review cited		
Other industry review process cited Please describe:		

3. EASE OF USE INVENTORY

3.1To conduct the lesson, what background knowledge or training is suggested for instructors? (Check all the apply)

	Materials state need for prior expertise	Materials IMPLY need for prior expertise
Expert background technical knowledge and/or work experience		
Training or Professional Development (offered by ATE site for a fee)		
Training or Professional Development (offered at no cost)		
Other Please describe:		

3.2Do the materials offer explicit suggestions and/or tips for how to successfully present the content to the students? Examples of suggestions and tips include offering discussion prompts for class discussion, providing open-ended questioning strategies, and guides on how to run student teams.

☐ Yes
☐ No

3.3To conduct the lesson, what required classroom materials are suggested? (Check all that apply)

	Materials STATE need for resource	Materials IMPLY need for resource
Standard school supplies (e.g., whiteboard, classroom, paper)		
Technology support / software / hardware: please describe (e.g., student internet access, GIS program software)		
Additional/special materials Please describe (e.g., robots, microscopes, projector, lab equipment)		
Special room or meeting space Please describe (e.g., laboratory)		
Ongoing replacement of materials Please describe (e.g., slides, specimens, test tubes, wiring)		

4. INSTRUCTIONAL MATERIALS COMPONENTS INVENTORY

4.1 What curriculum components are included in the materials?

7a. Curriculum Components	Included	Not Included
Instructor guide		
Student worksheets and handouts		
List(s) of equipment and materials needed		
Additional resources and activities for (not including assessment materials) – e.g., video, introductory materials:		
Instructor		
Students		
Lists of required pre-requisite student knowledge		
7b. Assessment Components		
End of unit/course test(s)		
Quizzes		
Item formats (check all available):		
True/False		
Multiple Choice/matching definitions with terminologies		
Open-ended questions		
Essay		
Answer key(s) / scoring guide(s)		
Other assessment tools, please describe (e.g., performance assessment):		

Appendix C. List of Reviewed Materials

ATE scoring materials checklist
NB: *** indicates that we have access to multiple modules

Type key:
IA – Instructional activity
LA – Lab activity
UG – User guide
LP – Lecture/presentation e.g., PowerPoints or video format
AS – Assessment
SY – Syllabus

Manufacturing

ATE Center	Materials	Type	File name
Collaborative Research: AutomationTech Hands-On Remote Labs Automation Curriculum ***	Module 1 - Introduction to Programmable Logic Controllers (PLC)	LP	PLC_Module1.pdf
http://atek.goivytech.net/	Lab material	LA	Robotics_Lab1.pdf
login: liliana.ructtinger@sri.com pass: sr11nternat1onal	Introductory material	LP	Robotics_Module_1.pdf
Florida Advanced Technological Education (FL-ATE) Regional Center for Manufacturing Education	Fact Sheet for completing project	LP	0_Company_Information.doc
	Teacher's guide	UG	Microsoft PowerPoint - 1_Featherlite_Challenge-Teacher_Copy.ppt
	Lesson plan	UG	3_Lesson_Plan_High_School.doc
	Data sheet		3_Datasheet.xls
	Student challenge instructions		3_CAD_Challenge HS.doc
	Teacher's copy of materials	UG	3_CAD_Challenge_HS_Teacher_Copy.ppt

ATE Center	Materials	Type	File name
Nanoscale Manufacturing Curriculum for Advanced Technological Education (Module 1 of 2) *** http://www.namcate.org/ login: teacher pass: teacher	Teaching material	LP	CC_A2_B3_STM.ppt CONTAINS LINK TO ONLINE TUTORIAL http://virlab.virginia.edu/VL/SPM_operation.htm
	Introductory reading material	LP	MODULE_B3_Narrative.doc
	Learning activity	LA	MODULE_B3_Learning_Activity_01.doc
	Learning activity	LA	MODULE_B3_Learning_Activity_02.doc
Midwest Coalition for Comprehensive Design Education (Module 1 of 2) *** http://www.purdue.edu/discoverypark/PLM/MCCDE/courses/prototyping/index.php http://www.purdue.edu/discoverypark/PLM/MCCDE/courses/collaboration/index.php http://www.purdue.edu/discoverypark/PLM/MCCDE/courses/simulation/index.html http://www.purdue.edu/discoverypark/PLM/MCCDE/courses/pdm/index.php	Class presentation	LP	Wagons-R-Us Reference 10-19-06.ppt
	Class presentation	UG	DFM_02.ppt
	Description of project	Article	Simulation+WagonsRUs.pdf
	Introduction to World Class Manufacturing – facilitators guide	UG	Intro+to+World+Class.pdf *NB: This 70+ page file has not been included in your packet due to questions about its relevance; please access through laptop*
	Introduction to World Class Manufacturing – participant journal	IA	Intro+to+World+Class+PJ.pdf *NB: This 110+ page file has not been included in your packet due to questions about its relevance; please access through laptop*

ATE Center	Materials	Type	File name
Virtual Science Lab (Module 1 of 2) http://www.virlab.virginia.edu/VL/contents.htm	*WEBSITE* UVA Virtual Lab: How Semiconductors and Transistors Work	UG	http://www.virlab.virginia.edu/VL/MOS_kit.htm/state/0 See the following document for instructions: PLEASE FOLLOW THIS LINK – virtual science lab.doc
	Lecture/presentation		Lecture 4 – Microfabrication.ppt
	Lab		Scanning%20Tunneling%20Microscope%20-%20UVA%20Operation%20Guide.pdf
Development and Field Test of an Internet-based Multimedia Simulation and Remote Laboratory System of Laser Cladding Technology for Technicians http://www.multitrex.edu/demos/	*WEBSITE* Machine control circuits	UG	http://www.multitrex.edu/demos/ELEfull/index.htm See the following document for instructions: PLEASE FOLLOW THIS LINK – laser cladding.doc
Advanced Aerospace Manufacturing Education Project (Module 1 of 2) http://www.elcamino.edu/academics/indtech/nsf/downloadfiles.asp	Powerpoint presentation	LP	composites_intro.ppt
	Instructor notes for the PowerPoint presentation complete with explanations for each slide, references and suggested student activities	UG	composites_intro.doc
The Northeast Biomanufacturing Center and Collaboration (NBCC)	Document containing lab procedures to follow for producing specific kind of cells/proteins. Targetted to students/ lab instructors perhaps.	LA	NBCC+materials.pdf

ATE Center	Materials	Type	File name
Plastics eLearning & PREP (Module 1 of 2) *** http://www.plastics-elearning.com/index.php?option=com_content&view=article&id=191%3Acompression-and-injection-molding&catid=23&Itemid=7	*WEBSITE* Thermoforming	LP	http://www.plastics-elearning.com/index.php?option=com_content&view=article&id=189%3Athermoforming&catid=23&Itemid=7 See the following document for instructions: PLEASE FOLLOW THIS LINK – Plastics eLearning.doc
The Molecular Literacy Project http://molit.concord.org/database/ PLEASE NOTE THIS ALSO APPEARS UNDER "IT"	*WEBSITE* Self-Assembly with Nanomanufacturing	UG, AS	http://molit.concord.org/database/activities/231.html See the following document for instructions: PLEASE FOLLOW THIS LINK – Molecular Literacy (Manufacturing).doc
Center for Nanotechnology Education and Utilization (Module 1 of 2) http://nano4me.live.subhub.com/? login: liliana.ructtinger@sri.com password: sriinternational	Lecture/presentation	LP	3_214_Lecture_Resists.ppt
	WEBSITE How a Plasma Etcher works		http://nano4me.live.subhub.com/categories/plasmaetcher See the following document for instructions: PLEASE FOLLOW THIS LINK – Center for Nanotech Ed and Utilization.doc
	Lab	LA	Microcontact Lab 10-8-08.doc
	Remote Access Lab Guide	UG	nickel nanowires 2009.pdf

ATE Center	Materials	Type	File name
Media Learning Objects http://electronics.wisc-online.com/	Online presentations of material – see links under "PLC Timers" heading		http://electronics.wisc-online.com/LDD.asp See the following document for instructions: PLEASE FOLLOW THESE LINKS – Media Learning Objects.doc
	Details of how assessment was carried out		http://electronics.wisc-online.com/assess.asp See the following document for instructions: PLEASE FOLLOW THESE LINKS – Media Learning Objects.doc
MatEd National Resource Center (Module 1 of 2) http://www.materialseducation.org/educators/labs_demos/	Powerpoint/lecture	LP	Advanced%20Composites%20from%20Joe%20Stuart%20PPT.pdf
	Instructor notes	UG	Joe%20Stuart%20Advanced%20Composites%20module%20final.pdf
Nanoscale Manufacturing Curriculum for Advanced Technological Education (Module 2 of 2) http://www.namcate.org/ login: teacher pass: teacher	*WEBSITE* Assessment – Deposition in the top-down process	AS	http://www.namcate.buffalo.edu/students/performace_assessment/Performance_Assessment_C4/quizmaker.html See the following document for instructions: PLEASE FOLLOW THIS LINK – Namcate2.doc
	Learning activity	IA	MODULE_C4_Learning_Activity_01.doc
	Introductory reading material	LP	MODULE_C4_Narrative.doc
	Learning activity	IA	MODULE_C4_Learning_Activity_02.doc
	Learning activity	IA	MODULE_C4_Learning_Activity_03.doc

ATE Center	Materials	Type	File name
Midwest Coalition for Comprehensive Design Education (Module 2 of 2)	*WEBSITE* Building a Spot Welding Simulation: Essential Elements of Robotic Simulation		http://www.purdue.edu/discoverypark/PLM/MCCDE/curriculum/modules/welding/index.htm See the following document for instructions: PLEASE FOLLOW THIS LINK – Midwest2.doc
MatEd National Resource Center (Module 2 of 2) http://www.materialseducation.org/educators/labs_demos/	Lab activity	LA	Lab6–MetalPropertiesandFailure.pdf
Center for Nanotechnology Education and Utilization (Module 2 of 2) http://nano4me.live.subhub.com/? login: liliana.ructtinger@sri.com pass: sriinternational	Lecture/presentation	LP	characterization 10 12 09.ppt
	Lab	LA	Intro to FESEM 9-21-09.doc
Virtual Science Lab (Module 2 of 2) http://www.virlab.virginia.edu/VL/contents.htm	*WEBSITE* UVA Virtual Lab: DNA (big picture)		http://www.virlab.virginia.edu/VL/DNA_big_picture.htm See the following document for instructions: PLEASE FOLLOW THIS LINK – Virtual2.doc
	Lecture/presentation		Lecture 8 – Self Assembly of Organic Molecules – Part II.ppt
	Lab		UVA_DNA_fingerprinting_manual.pdf

ATE Center	Materials	Type	File name
Advanced Aerospace Manufacturing Education Project (Module 2 of 2) *** http://www.elcamino.edu/academics/indtech/nsf/downloadfiles.asp	Powerpoint presentation		materialsfailure.ppt
	Instructor notes for the PowerPoint presentation complete with explanations for each slide, references and suggested student activities		materialsfailure.doc
Plastics eLearning & PREP (Module 2 of 2)	*WEBSITE* Compression and Injection Molding		http://www.plastics-elearning.com/index.php?option=com_content&view=article&id=191%3Acompression-and-injection-molding&catid=23&Itemid=7 See the following document for instructions: PLEASE FOLLOW THIS LINK -- Plastics eLearning2.doc

IT

ATE Center	Materials	Type	File name
Convergence Technology Center (Module 1 of 2)	Module 1: Learning Activity	IA	conv module 01_LA.doc
	Module 1: Assessment for learning outcome 1	AS	conv module 01_Assmt.ppt
	Module 1: Classroom presentation	LP	conv module 01_PP.ppt
	Syllabus	SY	Convergence Technology Curriculum_syllabus.doc
Convergence Technology Center (Module 2 of 2)	Module 2: Learning Activity	LA	conv module 02_LA.doc
	Module 2: Assessment for learning outcome 5	AS	conv module 02_Assmt.ppt
	Module 2: Classroom presentation	LP	conv module 02_PP.ppt
	Syllabus	SY	Convergence Technology Curriculum_syllabus.doc
Mapping, Analyzing and Problem Solving Using Geographic Information Science: Implementing a GIS Curriculum for Technical Literacy *** http://gis.lanecc.edu/maps-gis/modules	Computer Science 160 lesson	UG, IA	lesson-111708.rtf
	WEBSITE MAPS-GIS Tsunami and Earthquake Hazards: Oregon Coast		http://arcgis.lanecc.edu/website/quake/viewer.htm See the following document for instructions: PLEASE FOLLOW THIS LINK – MAPS-GIS.doc
	WEBSITE MAPS-GIS Crime and Drug Use		http://arcgis.lanecc.edu/website/crime/viewer.htm See the following document for instructions: PLEASE FOLLOW THIS LINK – MAPS-GIS.doc

ATE Center	Materials	Type	File name
Visual Digital Literacy Curricula and Modules for the IT Worker *** http://mcli.maricopa.edu/dvl/modules	Overview of modules offered		modules overview.htm
	Instructor Guide	UG	InstructorGuide_Blogging_v2009.pdf
	Class presentation	LP	Blogging_v2009.ppt
	Lab Assignment	LA	Blog lab_July2008.doc
Starting Point Teaching Entry Level Geoscience *** http://serc.carleton.edu/introgeo/browse_examples.html	Teacher instructions – Creating Topic-Specific Maps for Geoscience Classes	UG	Topic_GIS_Maps.html See website: http://serc.carleton.edu/introgeo/gis/Topic_GIS_Maps.html
	Lab exercises (teacher material) – floodplains in the field	UG, LA	GIS_Floodplains_Lab.html See website: http://serc.carleton.edu/introgeo/gis/examples/GIS_Floodplains_Lab.html
	Activity (teacher material) – mapping plate boundaries	IA	plbound.html See website: http://serc.carleton.edu/introgeo/interactive/examples/plbound.html
Geographical Information Systems Technology Implementation Project (GIS-TECH) *** http://gistr3.delmar.edu/gistech/ag.asp login: sriinternational pass: sriinternational	Tutorial on how to use software		Arcmap.pdf
	Tutorial on how to use software		Arcpad.pdf
	Tutorial		GIS in Agriculture.pdf
	Glossary		GIS_Definitions.pdf
	Tutorial on how to use equipment and software		GPS Data Transfer.pdf
	Safety training material		Kawasaki Mule 610.pdf
	Tutorial on how to use software		Rasters.pdf
	Tutorial on using eqmt and software		Serial Port.pdf
	Tutorial		Soil Sample.pdf
	Instructions for unzipping files		Unzipping Files.pdf

ATE Center	Materials	Type	File name
Using a Web-based GIS to Teach Problem-based Science in High School and College http://www.foothill.edu/fac/klenkeit/nsf/	*WEBSITE* Module 2: Water and fish		http://www.sjsu.edu/depts/geography/applications/Delta/Module2/home.html
Southwestern College Geographic Information Science & Technology http://www.swccd.edu/~gis/page72.html	Work packet for students	IA	Remote%20Sensing%20Image%20Analysis.pdf
Information Technology Across Career Clusters (ITAC 3) http://itac.edc.org/materials/materials_types.asp?cul=1	Lesson plan		Database_STEM_Meteorologist_Customized.doc
GeoTech – National Geospatial Technology Center of Excellence Login here: http://igett.delmar.edu/member.htm login: sriinternational pass: sriinternational Access course materials here: http://resources.geotechcenter.org/ SAME MATERIAL POOL AS THE CONCORD CONSORTIUM BELOW	Learning Unit Summary		DamBreach_jStenehjem-HO_July2008.pdf
	Instructor Guide	UG	DamBreach_jStenehjem-IG_July2008.pdf
	Student Guide	UG	DamBreach_jStenehjem-SG_July2008.pdf
	Support Document		DamBreach_jStenehjem-CS_July2008.pdf
	WEBSITE Data Files		http://gistr3.delmar.edu/igett/LU_Stene.html
Concord Consortium (community college with 37elmar37al programs, with three ATE Centers) Login here: http://igett.delmar.edu/member.htm login: sriinternational pass: sriinternational Access course materials here: http://resources.geotechcenter.org/ SAME MATERIAL POOL AS GEOTECH ABOVE	Learning Unit Summary		OsoBayLCCC_NelsonHO.pdf
	Instructor Guide	UG	OsoBayLCCC_Nelson_IG_June2008.pdf
	Student Worksheet	LA	LU_Student%20Worksheets.pdf
	Curriculum Support Guide		OsoBayLCCC_Nelson_CS_June2008.pdf
	WEBSITE Data files		http://gistr3.delmar.edu/igett/LU_Nelson.html

ATE Center	Materials	Type	File name
CSEC – Cyber Security Education Consortium	Learning Activity Packet	LA	PIA_Security Concepts LAP.doc
	Lecture	LP	PIA_Security Concepts Lecture.ppt
Workready Electronics SAME MATERIAL POOL AS MARICOPA BELOW	*WEBSITE* Course Materials: Data Conversion, Part I		http://www.work-readyelectronics.org/modules/wre_delivery/m005/m005.htm See the following document for instructions: PLEASE FOLLOW THIS LINK – Workready electronics.doc
Maricopa Advanced Technology Education Center SAME MATERIAL POOL AS WORKREADY ELECTRONICS ABOVE	*WEBSITE* Course Materials: Micro & Embedded Controllers, Part I		http://www.work-readyelectronics.org/modules/wre_delivery/m023/m023.htm http://www.work-readyelectronics.org/modules/wre_delivery/m023/m023.htm See the following document for instructions: PLEASE FOLLOW THIS LINK – Maricopa ATE.doc
CyberWATCH – Cyber Security: Washington Area Technician and Consortium Headquarters *** Login here: http://itsecurityeducation.com/cms/ login: sriinternational pass: sriinternational Access course materials here: http://itsecurityeducation.com/cms/index.php?option=com_content&view=category&id=45&Itemid=102	Background course information		CW 160 Security+overview.pdf
	Lab	LA	Ch.4_Hardening_Oses_MBSA.doc
	Lab	LA	3.5.1_Spyware Detection Prevention and Removal (Ad-Aware).doc
	Lecture/presentation	LP	ch04.ppt

ATE Center	Materials	Type	File name
CREATE – California Regional Consortium for Engineering Advances in Technological Education http://create-california.org/download_materials.htm	Course materials/presentation	LP	cwna chapter1v3.ppt
NWCET – National Workforce Center for Emerging Technologies http://www.nwcet.org/products/collCurr.asp	Includes program learner outcomes, key competencies, performance indicators, and assessment suggestions. May be used as a standalone course, as a module within a course, or may be infused throughout a sequence of courses or an entire program.		ModVirtualHelpDesk.pdf
Integrating GIS in Technologies Curricula (TEC GIS)		IA	GPS Lesson Plan.doc
The Molecular Literacy Project http://molit.concord.org/database/ PLEASE NOTE THIS ALSO APPEARS UNDER "MANUFACTURING"	*WEBSITE* Liquid Crystals: LCD Displays		http://molit.concord.org/database/activities/253.html%5C See the following document for instructions: PLEASE FOLLOW THIS LINK – Molecular Literacy (IT).doc
South Carolina Advanced Technological Education National Resource Center – SCATE http://www.scate.org/Educators/Cinfo/products.asp	Curriculum		core.pdf *NB: This 140+ page file has not been included in your packet due to its size; please access through laptop*
	Student handout	LA	handouts.pdf
	Instructor Guide	UG	instructor_gateway.pdf *NB: This 60+ page file has not been included in your packet due to its size; please access through laptop*

ATE Center	Materials	Type	File name
Center for the Advancement of Process Technology (CAPT) *** http://www.captech.org/curriculum/products.php	Instructor Manual	UG	OGSample.pdf
Active/Cooperative Learning: Best Practices in Engineering Education *** http://clte.asu.edu/active/lesscont.htm	*WEBSITE* Preparing - A good selection of activities that help instructors create a productive classroom environment.		http://clte.asu.edu/active/preparing.htm See the following document for instructions for all below: PLEASE FOLLOW THESE LINKS -- Active cooperative learning.doc
	WEBSITE Planning		http://clte.asu.edu/active/planning.htm
	WEBSITE Implementing		http://clte.asu.edu/active/implementing.htm
	WEBSITE Lessons & Activities		http://clte.asu.edu/active/lessons.htm
	WEBSITE Assessment		http://clte.asu.edu/active/assess.htm

Appendix D. Modified TECA

TECA: MODIFIED SURVEY (Version 1, 15 Dec 2009_AJ)

Material Name: ________________________________

Rater(s): ____________________________________

1. Rigorous Content: _____________________________

2. Quality Performance: _____________________________

3. Instructional Strategies: _____________________________

4. Problem Solving: _____________________________

5. General Education: _____________________________

6. Personal Qualities: _____________________________

7. Diversity: _____________________________

1. Rigorous Content

Are students required to apply rigorous mathematical concepts in new ways?
Yes or No

Do the materials require the students to solve problems that require understanding of science content? *Yes or No*

Do the materials require the students to think critically?
Yes or No

Are students asked to apply technological concepts to their work,
e.g., What impact will my work have on individuals, society and the environment?
e.g., Is there a better way to do this? *Yes or No*

Notes:

To what extent do the materials require students to learn rigorous content such as higher order thinking skills and in-depth understanding of the science, mathematics, engineering and technological concepts?

NA/DK	0	1	2	3	4

0: Materials *do not* require students to learn rigorous content.
1: Materials are *weak* at requiring students to learn rigorous content.
2: Materials are *adequate* at requiring students to learn rigorous content.
3: Materials are *good* at requiring students to learn rigorous content.
4: Materials are *excellent* at requiring students to learn rigorous content.

2. Quality Performance

Do the materials provide a variety of examples of professional work?
Yes or No

Do the materials contrast high and low quality work?
Yes or No

Do the materials discuss specific quality standards or guidelines? *Yes or No*

Notes:

To what extent do the materials help the learner to distinguish the difference between high quality and poor quality performance?

NA/DK	0	1	2	3	4

0: Materials *do not* distinguish between low quality and high quality performance.
1: Materials are *weak* at distinguishing between low quality and high quality performance.
2: Materials are *adequate* at distinguishing between low quality and high quality performance.
3: Materials are *good* at distinguishing between low quality and high quality performance.
4: Materials are *excellent* at distinguishing between low quality and high quality performance

3. Instructional Strategies

Do the materials suggest how to teach? *Yes or No*

Could the materials be used by someone unfamiliar with them? *Yes or No*

Do the materials recommend instructional resources? *Yes or No*

Do the materials provide any on-going support (e.g., listserv or website)? *Yes or No*

Do the materials offer strategies for adapting them to other situations
Yes or No
(e.g., grade, student population or content standard)?

Can activities be used by individuals as well as small groups and large groups of students? *Yes or No*

Can information be investigated in alternative ways?
Yes or No

Can information be presented in alternative ways? *Yes or No*

Notes:

To what extent do the materials support instructional strategies that actively engage all learners?

NA/DK	0	1	2	3	4

0: Materials *do not* support effective instructional strategies that actively engage all learners.
1: Materials are *weak* at supporting effective instructional strategies that actively engage all learners.
2: Materials are *adequate* at supporting effective instructional strategies that actively engage all learners.
3: Materials are *good* at supporting effective instructional strategies that actively engage all learners.
4: Materials are *excellent* at supporting effective instructional strategies that actively engage all learners.

4. Problem Solving

Are students required to recognize particular types of problems? *Yes or No*

Do the materials contain activities that require students to perform multiple steps before arriving at a solution? *Yes or No*

Do the materials contain activities that require students to collect information or data before making a decision? *Yes or No*

Are there activities that require students to consider constraints, risks, or alternatives before making a decision? *Yes or No*

Notes:

To what extent do the materials develop problem solving and critical thinking skills? That is, do the materials encourage students to learn how to approach problems, to think both creatively and analytically, and to make knowledge based decisions? NA/DK 0 1 2 3 4

0: Materials *do not* develop problem solving and critical thinking skills.
1: Materials are *weak* at developing problem solving and critical thinking skills.
2: Materials are *adequate* at developing problem solving and critical thinking skills.
3: Materials are *good* at developing problem solving and critical thinking skills.
4: Materials are *excellent* at developing problem solving and critical thinking skills.

5. Integration of General Education Content

Do the materials require students to locate, understand and interpret written information in professional documents, manuals, web sites or books? *Yes or No*

Are students required to communicate technical concepts verbally, in writing or in visual aides such as charts or graphs? *Yes or No*

Notes:

To what extent do the materials integrate general education skills such as English, technology and written and oral communication?

NA/DK 0 1 2 3 4

0: Materials *do not* integrate general education skills.
1: Materials are *weak* at integrating general education skills.
2: Materials are *adequate* at integrating general education skills.
3: Materials are *good* at integrating general education skills.
4: Materials are *excellent* at integrating general education skills.

6. Personal Qualities

Do the materials require students to coordinate their efforts with others? Yes or No

Are there activities or assessments that require students to meet deadlines? Yes or No

Are there opportunities for students to demonstrate individual responsibility? Yes or No

Do the materials contain activities that require students to manage their own behaviors? Yes or No

Do the materials contain activities that require students to set their own levels of personal performance? Yes or No

Notes:

How well do the materials develop personal qualities required for professional employment?
These might include character traits, behaviors and attitudes that are needed for personal growth and professional development such as responsibility, self-management and integrity.

NA/DK 0 1 2 3 4

0: Materials *do not* develop personal qualities needed for professional employment.
1: Materials are *weak* at developing personal qualities needed for professional employment.
2: Materials are *adequate* at developing personal qualities needed for professional employment.
3: Materials are *good* at developing personal qualities needed for professional employment.
4: Materials are *excellent* at developing personal qualities needed for professional employment.

7. Diversity

Do the materials include examples from a variety of types of workplaces and settings?
Yes or No

Do the materials encourage students to understand how to work with people from different *backgrounds?* *Yes or No*

Do the materials reflect the growing diversity of the workforce? *Yes or No*

Do the materials include references that broaden the students' awareness of different cultural and socioeconomic groups? *Yes or No*

Notes:

To what extent do the materials reflect the experiences and perspectives of different cultural and socioeconomic groups?					
NA/DK	0	1	2	3	4

0: Materials *do not* reflect perspectives of different cultural and socioeconomic groups.
1: Materials are *weak* at reflecting perspectives of different cultural and socioeconomic groups.
2: Materials are *adequate* at reflecting perspectives of different cultural and socioeconomic groups.

3: Materials are *good* at reflecting perspectives of different cultural and socioeconomic groups.
4: Materials are *excellent* at reflecting perspectives of different cultural and socioeconomic groups.

Appendix E. TECA Decision Rules

TECA Decision Rules

Quality Performance

Rating	Definition
0	No reference to quality performance
1	Activity includes learning objectives
2	Activity references or describes high and low performance
3	Activity contains enough information to deduce a gradient of performance
4	Activity includes assessment rubric

Instructional Strategies

Rating	Definition
0	No components are included
1	One component is included
2	Two components are included
3	Three components are included
4	All of the components are included

Components:

- Activity features two or more pedagogical delivery modes (lecture, lab, discussion, group work, etc.)
- Activity contains tips for customization
- Activity explicitly accommodates different classroom setups (small group, large lecture, etc.)
- Activity contains supplemental instructional resources

Problem Solving

Rating	Definition
0	No components are included
1	One component is included
2	Two components are included
3	Three components are included
4	All of the components are included

Components:

- Students solve problems in different ways
- Students perform multiple implicit steps before arriving at a solution

- Students collect information or data before making a decision
- Students consider constraints, risks, or alternatives before making a decision

General Education

Rating	Definition
0	Activity does not contain general education features
1	Activity requires additional oral or written communication.
2	Activity requires a formal oral or written product
3	Activity is interdisciplinary, but its elements are highly segmented
4	Activity is interdisciplinary, and its elements are highly integrated

Personal Qualities

Rating	Definition
0	No components are included
1	One component is included
2	Two components are included
3	Three components are included
4	All of the components are included

Components:

- Students follow directions or procedures
- Students work with others
- Students manage their own time to complete the activity
- Students submit a work plan prior to completing the activity

Appendix F. Comparison of TECA and Suitability Inventory Scoring Time and Length of Selected Instructional Materials

	TECA Scoring Time (minutes)	Suitability Scoring Time (minutes)	Learning Activity Presentation Format, # pages
M3		12	28 pages, 24 PPT slides, 22 web pages, 3-minute animation/video
M4			102 pages, 58 PPT slides
M5		20	27 pages, 35 PPT slides, 20 web pages, 2-minute video
M6		10	27 web pages, 40-second video
M8			17 pages, program
M10	15	15	11 web pages, 2:30 minute video
M11		10	9 pages, 26 PPT slides, 2:30 minute video
M12	5	15	56 web pages, 2:50 minute video
M14	10		37 pages on the web
M15		10	51 web pages, 50-minute video
M16	5		5 pages
M17			2 pages, 168 PPT slides
M20	2	10	21 web pages, 1:54 minute video
IT4	10		32 pages, 55 PPT slides
IT5	10		10 web pages
IT14	5		37 PPT pages on web
IT15	10		72 PPT pages on web
IT18	10		43 pages
IT20	10		14 interactive web pages
IT21	10		220 pages
Average Scoring Time	**8.5**	**12.75**	

Appendix G. Conceptual Correspondences between the Suitability Inventory and TECA

TECA Item	Suitability Inventory Item	Degree of Conceptual Alignment
V. Quality Performance 5. To what extent do the materials help the learner to distinguish the difference between high quality and poor quality performance? (Industry and Content)	**9. Components:** Scoring Keys	Moderate. TECA was operationalized to give the highest score to materials with scoring keys.
I. Instructional Strategies 1. To what extent do the materials support instructional strategies that actively engage all learners? (Curriculum, Instruction, and Assessment)	**1a. Materials Appropriateness** Do the materials indicate which of these students can be served by the materials? (Special education, ELL, Adult career transition); **7. Teaching Tips** Do the materials offer suggestions and/or tips for how to successfully present the content to the students such as open-ended questioning strategies, how to run student teams, ways to elicit student participation in discussions?; **9. Components:** Instructor Guide	Moderate. TECA item refers to materials as a support to instructional strategies that are appropriate for all learners, whereas the Suitability item refers to the materials themselves, not their entailed instructional strategies, that are appropriate to learners. 2) Also, the Suitability Items requires a rating of appropriateness per student sub-group, whereas the TECA asks for an overall rating, which does not differentiate among sub-groups. We expected moderate alignment with the Tips on Use and Instructor Guide, since both elements provide instructional guidance.

TECA Item	Suitability Inventory Item	Degree of Conceptual Alignment

III. Integration of General Education Content 3. To what extent do the materials integrate general education skills such as English, technology, and written and oral communication? (Curriculum, Instruction, and Assessment)	**3a. Industry learning Goals:** Do the materials articulate and address the following industry learning goals? Professional Skills: Communication and Presentation	Moderate. Both items address the presence of opportunities to apply communication skills in a technician education context.
V. Personal Qualities 5. How well do the materials develop personal qualities required for professional employment? These might include character traits, behaviors and attitudes that are needed for personal growth and professional development such as responsibility, self-management and integrity. (Curriculum, Instruction, and Assessment)	**3a. Industry learning Goals:** Do the materials articulate and address the following industry learning goals? Professional Skills: Teamwork and Project Management	Moderate. Both items address the presence of opportunities to work in teams and manage a project in a technician education context.