# Evaluation of Materials Produced By the ATE Program

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## Executive Summary

This report describes the outcomes and processes used to determine expert opinion of the quality of materials developed through the ATE program. A detailed scoring rubric was developed based on existing research and expert review, and experts in technological fields, instructional design, and technological education used the rubric to review the materials. Of the 65 projects and centers that had reported being involved in materials development on the yearly ATE survey in 2002, 37 responded to our request to send us a copy of their best material to review. Preliminary review reduced the number of materials to 29 judged suitable and sufficiently complete for review. Of the 29 materials, 23 were judged adequate or better overall while the remaining 6 were judged as weak. Of these 23, 14 received overall ratings of good or better; 2 were judged to be excellent, 2 as good to excellent, and 10 as good.

Comparisons of the materials within various categories showed a good deal of variation in ratings. There were some trends showing that materials developed more recently, materials with a greater span, and materials produced by projects and centers with more funding received higher ratings. Generally, the materials were rated lower on the rubric item related to workplace competencies than the items related to industry standards and practices, real world curriculum, and access to in-depth understanding. The comparison of high- and low-rated materials shows that there was no overlap in the ratings for the industry and content items of the rubric or for the assessment and integration of general education items on the curriculum, instruction, and assessment items.

Recommendations include continuing the changes already begun in the ATE program toward more careful awarding of materials development efforts. Additionally, materials development efforts should concentrate more on incorporating workplace competencies. Projects and centers that develop materials need to emphasize the incorporation of industry expectations, rigorous content, applications of science, technology and mathematics concepts, general education skills, and quality assessments.

**Evaluation Materials Produced by the ATE Program**

Since 1999, The Evaluation Center at Western Michigan University and the University of Minnesota have collaborated to evaluate the overall Advanced Technological Education (ATE) program. This large-scale evaluation is being conducted as one means by which NSF assures accountability of its programs. Therefore, this report was prepared for the NSF directorate as well as for the ATE program staff. Additionally, because our data sources are products from individual projects, we anticipate that project directors and persons hoping to engage in ATE projects will also be interested in the findings.

The total evaluation effort includes multiple parts that focus on key components of the ATE program. Materials development, the subject of this study, is one such key component. While there are multiple reasons for evaluating this component, a principal reason is its long-term, prominent role in the program. Materials development has been an important part of the program since its inception. The ATE program continues to provide substantial support for developing curricular materials. For example, in 2002, 65 of 76 ATE projects surveyed (86%) reported engaging in such development efforts. Additionally, we note that the current Program Solicitation (http://www.nsf.gov/pubs/2003/nsf03523/nsf03523.htm#pgm_desc_txt) lists curricular materials development as a key program component: ". . . the ATE program promotes improvement in technological education at the undergraduate and secondary school levels by supporting curriculum development . . ."

Our evaluation of ATE projects' materials development efforts is being conducted in two steps, first an examination of the quality of materials produced and then an assessment of the effects of instruction with these materials. This report addresses the first step, a look at materials' quality, which we believe can be used by the ATE program to address its concerns for both program accountability and program development.

This report is divided into several major sections with details provided in a series of appendices. The first sections follow the time line presented in Appendix 1 and outline the process: *Collection and Description of Materials, Selection of Reviewers, Development of the Rubric, Training of Reviewers,* and *Reviewing Materials*. These process-oriented sections are followed by the *Results of the Material Review*, *Findings,* and *Recommendations*.

***Collection and Description of Materials***

ATE centers and projects that reported developing materials on the annual Web-based ATE survey in spring 2002 served as the sample. These 65 ATE centers or projects were contacted via e-mail in October 2002. They were asked to send their "best" material and to complete a short questionnaire regarding the audience and scope of their material. (See Appendix II.) This questionnaire also asked them to identify someone they thought was qualified to evaluate the materials they were sending. The evaluation project offered to pay for mailing and copying of the materials. After several follow-ups, via both e-mail and telephone, materials were received from 37 ATE projects and centers, a 57 percent response rate. The following table details the results of this collection effort.

**Table 1: Results of Collection Effort**

| Materials Received | Materials Not Received |
|---|---|
| **31** Materials were received and processed to be rated | **10** Did not respond in any way to e-mails or voice messages (2 of these projects were officially ended before our solicitations; 1 project had a new PI) |
| **6** Materials were received but not rated because they were not classroom-based curricular materials | **7** Responded to one or more e-mail or voice mail messages and agreed to send materials, but these materials were never received (2 of these projects were officially ended before our solicitation; 1 project had a new PI) |
| | **4** Responded that the materials were incomplete and therefore could not be evaluated |
| | **4** Responded that they did not develop materials |
| | **3** Responded that they developed materials, but not curriculum-based materials for use in a classroom or laboratory. |
| **37** Materials received | **28** No materials received |

Total - **65** ATE Centers and projects which composed our sample

***Note** It must be kept in mind that the 65 may only approximate the real population of interest. Also, only 55 (or 85%) really responded to our queries, so the sample might be considered to be 55. Also of the 65, 13 could not be rated so the true sample population might be considered 52. Therefore, the 31 obtained might be considered 59.6% of the ATE projects and centers presumably having relevant materials.*

We received a wide range of materials that were grouped according to subject areas, curricular purpose, format, funding category, location of use, developer's location, start date, and amount of funding, as can be seen from the table of characteristics below. The materials were obtained from 2- and 4-year colleges, high schools, projects, and centers. Award dates ranged from 1998-2002, and amounts of funding ranged from just over $200,000 to just over $2 million. The materials covered a broad range of subject areas: physics, chemistry, electronics, environment, IT, manufacturing, and engineering. Materials had been developed as full courses, modules, sets of modules or supplemental materials. Curricular materials could constitute an entire piece of work, such as a text, or a single chapter from a larger piece of work, such as a packet or binder.

Material format ranged from bound colorful texts and finished multimedia CD-ROMs to loose papers and Word documents simply saved to a CD or diskette. In these cases the Word documents were printed out for the reviewers. Although most materials were clearly classroom-based curriculum, some were geared toward marketing a specific profession or industry or were a reference material for professional standards and codes. Some materials were entirely Web-based, and others had major Web-based components to complement written materials. Some

Web-based materials were unsecured Internet sites, and others were secured Web CT environments.

**Table 2: Factors Describing Materials**

| Factor[a] | Variable Attributes and Number of Materials with the Attribute (N) |
|---|---|
| Content Area | · Chemistry and Biotechnology (4)<br>· Electronics and Electrical Concepts (4)<br>· Environmental Issues (3)<br>· Information Technology (IT) and Computers (5)<br>· Manufacturing and Automated Design (5)<br>· Physics and General Engineering (6)<br>· Other (2) |
| Type of Material | · Course - material developed for an entire course (6)<br>· Module - material that contained enough content to stand alone and was likely to be used within a single course (9)<br>· Multiple modules - material had multiple parts that could stand alone and was likely to be used across several courses within a program of study (11)<br>· Supplement - material that lacked enough content to stand alone and was likely to augment a single course (3) |
| Format | · Binder – 3-hole punched paper organized in a binder, usually with a table of contents (2)<br>· CD-ROM - Materials received on CD. Materials ranged from files of Word documents simply saved on a CD to hypertext and multimedia documents (6)<br>· Combination - any combination of two or more format categories (5)<br>· Packets - binder clipped or loose paper; usually the shortest materials (5)<br>· Text - materials that were received spiral or perfect bound; usually logically organized and containing a table of contents (7)<br>· Web site - materials designed for an online format. Web sites ranged from unsecured Internet sites to secured spaces within a Web CT environment (4) |
| Funding Category | · Project (23)<br>· Center (6) |
| Planned | · Course (1) |

| Factor[a] | Variable Attributes and Number of Materials with the Attribute (N) |
|---|---|
| Location of Use[b] | · Local (3)<br>· Elsewhere (12)<br>· Commercial publication (12) |
| Developer's Organization | · 4 year college/university (4)<br>· 2 year college (20)<br>· Other (5) |
| Start Date | · 1998 and prior (2)<br>· January-December 1999 (8)<br>· January-June 2000 (8)<br>· July-December 2000 (8)<br>· 2001 and beyond (3) |
| Amount of Funding (in millions) | · 2.0+ (4)<br>· 1.0-1.99 (4)<br>· .5-.99 (11)<br>· .2-.49 (10) |

[a] For all factors except "Planned Location of Use," 29 of 31 materials were rated. Two were deemed too incomplete for review.

[b] Twenty-eight of the 29 sites whose materials were rated responded to the survey questions on use.

***Selection of Reviewers***

Reviewers were selected to represent expertise in industry, curriculum, and use of technological education materials. A database of 60 potential reviewers was developed via PI questionnaire responses, requests for reviewers at the 2002 annual PI meeting, evaluation advisory committee recommendations, a textbook author and literature search, and an industry search for experts. These 60 individuals were contacted and asked about their willingness to serve and to provide a short curriculum vita. Based on the reviewers' expertise, they were classified as industrial experts, curriculum experts, or instructional experts. The list was also sent to the ATE material developers to identify any potential conflicts of interest. Expert reviewers were then matched with the materials we had received, and 18 reviewers were invited to attend a meeting for training on using the rubrics and rating the materials. Reviewers were matched to materials as closely as possible. For example, if we had a Web-based mechanical engineering material, we chose as reviewers mechanical engineering industry experts, curricular experts in Web-based instruction (and often in the specific content area as well), and instructional experts with experience teaching Web-based mechanical engineering classes. Each material was assigned 3 reviewers, 1 from each category of experts: industrial, curricular, and instructional. Reviewers

assessed 3 to 7 materials depending on how many were in their area of expertise. See Appendix III for details on the reviewers' qualifications.

***Development of the Rubric***

A complex rubric and process were developed to guide the assessment of the materials. The rubric was developed using a theoretical framework and revised based on input from assessment specialists and the ATE evaluation advisory committee as well as the material developers themselves. The final rubric included four parts with each part serving a different purpose:

1. an industrial/content review containing five items: quality performance, rigorous content, use of technology, application, and alignment

2. a curriculum, instruction, and assessment (CI&A) view containing six items: diversity, personal qualities, assessment, integration of general education, problem solving, and instructional strategies

3. a holistic view integrating the industrial/content and curricular reviews containing four items: industry standards and practices, real world curriculum, workplace competencies and access to in-depth understanding

4. a single overall rating of the quality of the material: to what extent will the materials help students learn the knowledge and skills or practices needed to be successful in the technical workplace?

As the schema below shows, the process involved three steps for each reviewer: (1) evaluation of the materials set based on the industrial/content or CI&A criteria, (2) a holistic evaluation, and (3) an overall evaluation. In addition to highlighting different parts of technology education, the process leads naturally from specific to more global assessments. As the steps suggest, the specific criteria were intended to organize thinking for completing the holistic evaluation and, in turn, it prepared reviewers for the overall evaluation.

The purpose of the different parts was to highlight different aspects of technological education and to provide both detailed and collective views. All items were rated on a 0-4 basis with an NA/Don't Know option as well. A 0 meant the material did not do whatever the item specified, a 1 meant the material was weak at doing it, a 2 meant adequate, a 3 meant good, and a 4 meant excellent. A detailed description of the development, references, and the rubric itself are contained in Appendix IV.

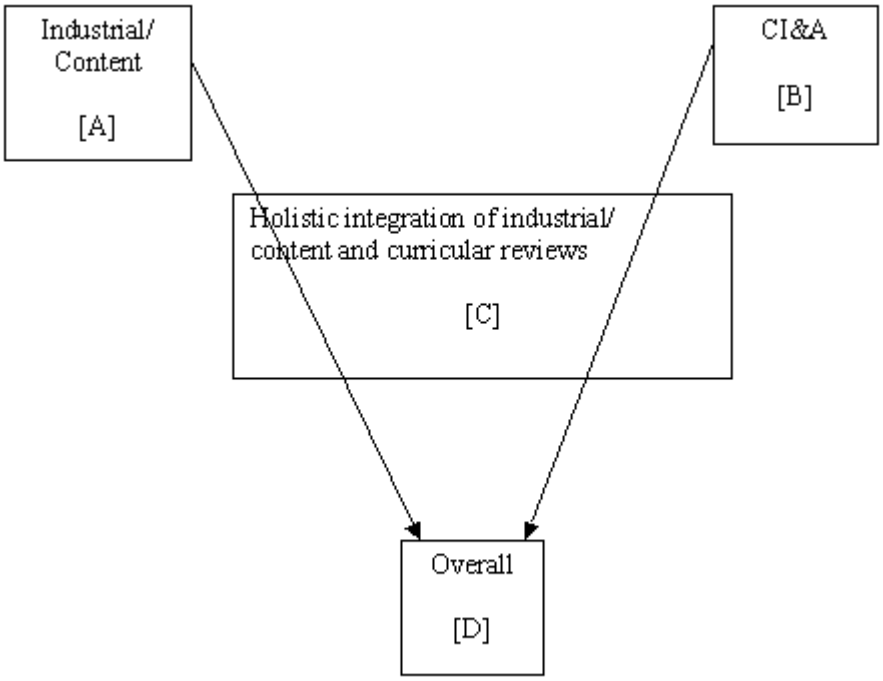



**Figure 1: Materials Review Process**

***Training of Reviewers***

Reviewers spent two days at the University of Minnesota being trained on the rubric and evaluating the materials. Reviewers received four hours of training on the rubric. During the training, they had the opportunity to use the rubric to evaluate three different pieces of curricular materials that reflected a wide range of pedagogical and industrial quality. As they would be doing with the ATE materials, reviewers rated each training material independently and then compared their ratings within small groups. Finally, a large group discussion was held to share and discuss ratings. This allowed everyone to fully understand the rubrics and to agree on what constituted the different levels of ratings. A high degree of consensus in interpreting the rubric was obtained. Agreement within and across groups was within one point on the rating scales. After the four-hour training session, the group of reviewers separated to review the materials.

***Reviewing Materials***

Each material was rated once by each type of expert (i.e., industrial, curricular, and instructional) using one of the first two parts of the rubric (industrial or curricular) and then the holistic and overall parts and once by the team using the second two parts of the rubric (holistic and overall). For a given material, the industrial expert reviewer completed the industry part of the rubric, the holistic part, and the overall part. The curricular expert reviewer completed the curricular part of the rubric, the holistic part, and the overall part. The instructional expert reviewer completed

either the curricular or the industry part of the rubric, depending on where s/he felt most competent; the holistic part; and the overall part. (As a result, both the holistic and overview rubrics received three independent ratings; the industrial/content and the CI&A rubric each received at least one rating; and one of the two received two ratings, depending upon the expertise of the instructional expert.) Then the three reviewers met and discussed their individual ratings and provided a team rating for each holistic item and the overall item on the rubric. The team rating scores were obtained as a means to increase the validity of the holistic and overview ratings (i.e., to help ensure that both holistic and overview ratings were fully informed by the expertise of all members of the rating team). The team rating was then treated as a separate score, providing a total of four scores (three individual and one team score) for calculating the average score for the rubric.[1]

The ATE evaluation team members checked and reviewed for completeness each individual reviewer's comments as they were completed. The ATE evaluation team members also monitored group meetings and checked and reviewed the group ratings for completeness. Detailed analyses of the interrater, intrarater, and intragroup reliabilities showed strong agreement and therefore support the validity of the ratings. Details are provided in Appendix V.

***Results of Material Review***

In analyzing the results of the ratings of the materials, we sought to answer summative and formative questions about the materials.

- The summative question, "Are the materials developed through the ATE program of good quality?" was answered through an analysis of the reviewers' ratings on the overall item: "To what extent will the materials help students learn the knowledge and skills or practices needed to be successful in the technical workplace?" This question was answered for the materials as a group and for the materials organized by different factors to assess the relationship between those factors and the overall ratings.

- Formative information was provided through consideration of the ranges of ratings on the holistic items, which provide indications of quality in more specific areas, and through a comparison of the ratings of the four highest and lowest rated materials on all of the rubric items. This comparison highlights the qualities that were strong in the highest rated materials but weaker in the lower rated ones and provide a clear sense of the differences that exist between these two sets of materials.

Data analyses provide mean scores across raters for each set of materials; the tables below provide averages and ranges of the mean ratings to both describe results obtained from the review process and to facilitate generalizations to other similar materials development efforts.[2]

[1] This overall average method is consistent with the practice employed for generating NSF review panel scores. This method adds in the group result, giving it a weight equal to the ratings of a person on the panel.

[2] Data analyses for statistical inference purposes were not conducted because the scoring mechanisms and sampling procedures do not meet underlying assumptions of independence and random selection/-assignment.

The ratings reveal a wide range of quality among the ATE materials. Table 3 presents several different types of data about the ratings of the materials. The first column shows the range of ratings provided for the review materials, while the second column describes what the rating meant. For example, materials that were rated a 1 were perceived by reviewers as weak at helping students learn the knowledge and skills or practices needed to be successful in the technical workplace. Materials rated a 2 were perceived as adequate at helping students, and so on. The last two columns show the number of materials and the percentage of materials receiving each of the overall ratings. The middle columns show the average ratings on the holistic items of the rubric calculated for the set of materials receiving each of the overall ratings of 1-4. The holistic items include Industry Standards and Practices, Real World Curriculum, Workplace Competencies, and Access to In-Depth Understanding. For example, the ratings on the standards item assigned to each of the six materials that received a 1 on the overall item were averaged to obtain the mean of 1.5 presented in the table.

As can be seen in the table, the ratings for the materials spanned almost the full range of ratings (no materials received a zero). Of the 29 materials, 23 were judged adequate or better overall while the remaining 6 were judged as weak. Of these 23, 14 received overall ratings of good or better; 2 were judged excellent, 2 as good to excellent, and 10 as good. With few exceptions the averages for the holistic items follow the same ordering as the overall item. For the material with an overall team rating of 2.5, the averages for Industry Standards and Practices (1.8), Real World Curriculum (1.8), and Workplace Competencies (1.5) are lower than they should be if the order in the overall item were being followed. For materials rated as a 3.5 overall, Industry Standards and Practices (2.8) once again appeared discrepant from following the ordering of the overall item. In addition, the averages for the workplace competency item tend to be slightly lower than the ratings of the other holistic items.

In order to maintain anonymity, individual ratings by material are not presented. Instead, the average and range of ratings of the materials on the overall rubric item on eight factors are provided in Table 4. The factors are the same as those presented earlier to describe the materials: content area of material, type of material, format of material, ATE funding category, planned location of use of the material, developer's organization, year of receipt of ATE funding, and amount of ATE funding received. These factors and their attributes are presented along with the number of materials in each subcategory in order of the average ratings received by the set of materials in each.

**Table 3: Overall Team Ratings Received by ATE Materials**

| | | *Average Holistic Ratings* | | | | | |
|---|---|---|---|---|---|---|---|
| **Overall Team Rating** | **Description of Rating** | ***Standards*** | ***Real World*** | ***Work-Place*** | ***In Depth*** | **Number of Materials** | **Percentage** |
| | | | | | | | |
| 0 | do not | | | | | 0 | 0% |
| 1 | weak | 1.5 | 0.9 | 0.7 | 1.3 | 6 | 21% |
| 2 | adequate | 2.0 | 1.9 | 2.0 | 2.1 | 8 | 28% |
| 2.5 | | 1.8 | 1.8 | 1.5 | 2.5 | 1 | 3% |
| 3 | good | 3.1 | 3.1 | 2.7 | 3.0 | 10 | 34% |
| 3.5 | | 2.8 | 3.1 | 3.0 | 3.5 | 2 | 7% |
| 4 | excellent | 3.7 | 3.9 | 3.4 | 4.0 | 2 | 7% |

The range of ratings is the highest and lowest rating received by any material in the set by the teams of raters on the overall item. The data in the table show that none of the factors produce strong differences in the ratings the materials received. Every factor contained both lower and higher quality materials, materials from any content area might be of high or low quality, both 2 year and 4 year institutions can produce materials of high or low quality, etc. No factor offers a fail-safe basis for assuring high quality materials.

Despite the overlap in the quality of materials from all of the different categories, four categorizations had stronger indications of relationships than the others: type of material, planned use, year of funding, and amount of funding. It appears that those materials developed for use across multiple courses or for a full course are of higher quality than those developed as modules or supplements. Also, materials that developers plan to use in external or commercial contexts were rated higher than those planned for use locally.

Somewhat surprisingly, the quality of the materials produced appears to be inversely related to the length of time a project or center has been in operation except for projects and centers with start dates before 1998. This counterintuitive finding that less time tended to produce better materials may be due to the increasingly more demanding requirements for materials development in the ATE program requests for proposals. Additionally, some of the more recent funding dates may have been second rounds of funding to sites already involved in producing materials worthy of additional funding.

Finally, it appears that the very highly funded projects and centers produced materials with higher ratings than the lowest funded projects and centers. This finding is consistent with appropriate use of funds by the ATE program. It must be kept in mind, however, that this factor is highly confounded with others. Centers receive more funding than projects. Projects or centers operating for longer periods of time tend to receive more money. Projects or centers receiving more money generally have larger staffs and engage in other activities that might be complementary to materials development, etc. Additionally, it must be kept in mind that total amount of funding (the variable used in the categorization) does not indicate how much money was spent specifically on development of materials.

**Table 4: Overall Means and Range of Overall Team Ratings by Factor**

| Factor | Factor Attribute | Number of Materials With Attribute | Overall Mean | Range of Overall Team Ratings |
|---|---|---|---|---|
| Content Area | Physics-Engineering | 6 | 3.1 | 2.0 - 4.0 |
| | Environmental | 3 | 2.8 | 2.0 - 3.5 |
| | Chem-Biotech | 4 | 2.7 | 2.0 - 3.0 |
| | Manufacturing | 5 | 2.4 | 1.0 - 3.0 |
| | Electronics | 4 | 2.3 | 1.0 - 4.0 |
| | I.T./Computers | 5 | 1.9 | 1.0 - 3.0 |
| | Other | 2 | 1.0 | 1.0 - 1.0 |

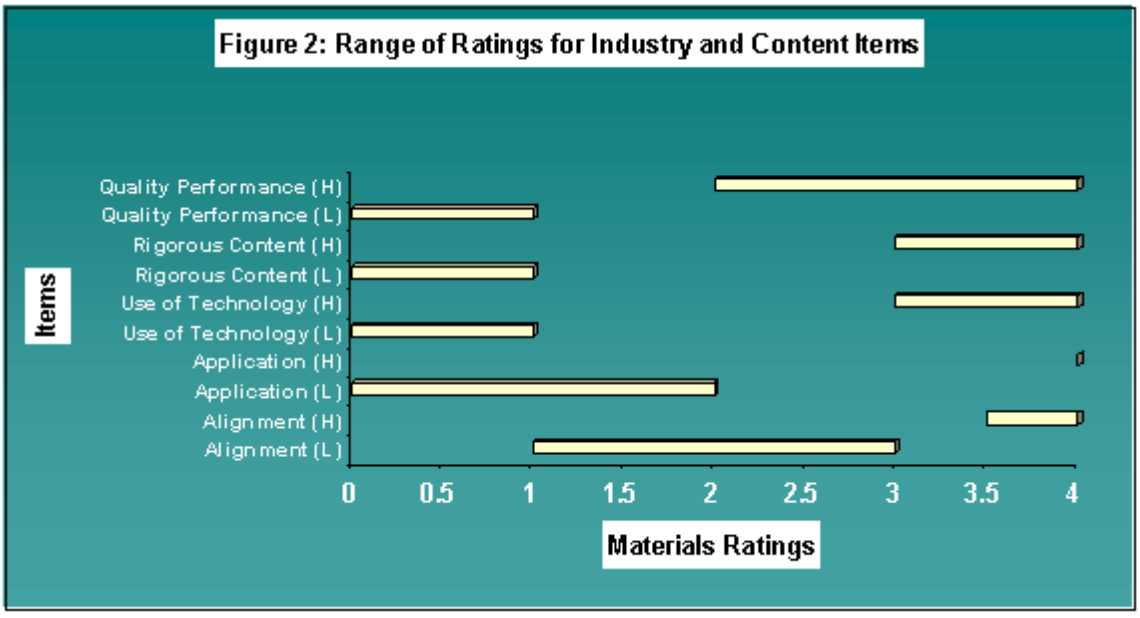
| Factor | Factor Attribute | Number of Materials With Attribute | Overall Mean | Range of Overall Team Ratings |
|---|---|---|---|---|
| | | | | |
| Type of Material | Multiple Modules | 11 | 2.8 | 1.0 - 4.0 |
| | Course | 6 | 2.7 | 2.0 - 3.5 |
| | Module | 9 | 2.1 | 1.0 - 3.0 |
| | Supplement | 3 | 1.7 | 1.0 - 2.0 |
| | | | | |
| Format | Text | 7 | 2.9 | 2.0 - 4.0 |
| | Combination | 5 | 2.5 | 1.0 - 4.0 |
| | Web | 4 | 2.5 | 1.0 - 3.0 |
| | Binder | 2 | 2.4 | 2.5 - 3.0 |
| | Packet | 5 | 2.3 | 1.0 - 3.5 |
| | CD-ROM | 6 | 2.1 | 1.0 - 3.0 |
| | | | | |
| Funding Category | Center | 6 | 3.0 | 2.0 - 4.0 |
| | Project | 23 | 2.3 | 1.0 - 3.5 |
| | | | | |
| Planned Location of Use | Elsewhere | 12 | 2.8 | 1.0 - 4.0 |
| | Commercial | 12 | 2.5 | 1.0 - 4.0 |
| | Course | 1 | 1.6 | 0.5 - 2.0 |
| | Local | 3 | 1.4 | 1.0 - 2.0 |
| | | | | |
| Developer's Organization | 2 year college | 20 | 2.6 | 1.0 - 4.0 |
| | 4-year college/university | 4 | 2.4 | 1.0 - 3.0 |
| | Other | 5 | 2.1 | 1.0 - 2.5 |
| | | | | |
| Start Date | 1998 and Prior | 2 | 3.2 | 3.0 - 4.0 |
| | 2001 and Beyond | 3 | 2.8 | 2.0 - 3.5 |
| | July-Dec., 2000 | 8 | 2.6 | 1.0 - 3.5 |
| | Jan.-June, 2000 | 8 | 2.3 | 1.0 - 3.0 |
| | Jan.-Dec., 1999 | 8 | 2.2 | 1.0 - 4.0 |
| | | | | |
| Amount of Funding (in millions) | 2.0+ | 4 | 3.3 | 2.0 - 4.0 |
| | 1.0-1.99 | 4 | 2.5 | 1.0 - 3.0 |
| | .5-.99 | 11 | 2.4 | 1.0 - 3.5 |
| | .2-.49 | 10 | 2.3 | 1.0 - 3.0 |

***Top rated materials***. Four materials stand out as being top rated because they score considerably higher than the other rated materials. Each of these materials is of excellent quality and obtained an overall team rating of 3.5 or 4.0. Table 5 provides an overview of these four materials.

**Table 5: Characteristics of Four Top-Rated Materials**

| Overall Team Rating | Content Area | Type of Material | Material Format | Funding Category | Planned Location of Use | Developer's Organization | Start Date | Award Amount to Date |
|---|---|---|---|---|---|---|---|---|
| 4 | Engineering Technology | Multiple Modules | Combination: texts & packets | Center | Elsewhere | 2 year college | Sep-99 | $2,000,000 |
| 4 | Electrical - Mechanical Engineering (With Ethical Case Studies) | Multiple Modules | Text(s) | Center | Commercial | 2 year college | Sep-98 | $2,000,000 |
| 3.5 | Engineering Technology | Course | Packet | Center | Commercially | 2 year college | Sep-00 | $2,000,000 |
| 3.5 | Environmental Science | Course | Text | Project | Elsewhere | 2 year college | Oct-01 | $1,000,000 |

The four highest and lowest rated materials (based on overall ratings) were further compared on the individual rubric items, the holistic items, and the overall item to determine if there were any specific differences that might provide guidance for future materials development. These comparisons are presented below in Figures 2-4 and Tables 6-7. The contrasts show that there were large differences (no overlap of means) between the four highest and lowest rated materials on the ratings for the individual industry and content items and no overlap on two of the individual curriculum, instruction, and assessment items: assessment and integration of general education. There also was no overlap of the ranges for the highest and lowest rated materials on the holistic or overall items.



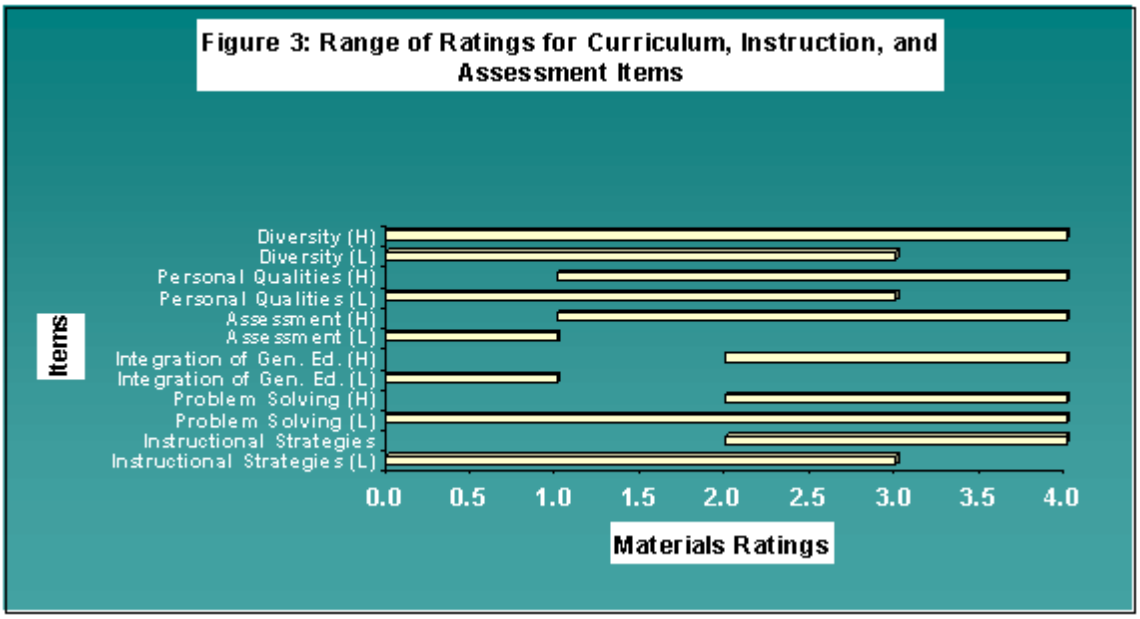



**Table 6: Contrast Between Highest and Lowest Rated Materials by Item**

| Industry and Content | | | | | Curriculum, Instruction, & Assessment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Lowest 4 | | Highest 4 | | | Lowest 4 | | Highest 4 | |
| Item | Mean | Range | Mean | Range | Item | Mean | Range | Mean | Range |
| Alignment | 1.3 | 1.0-3.0 | 3.9 | 3.5-4.0 | Instructional Strategies | 1.3 | 0.0-3.0 | 2.9 | 2.0-4.0 |
| Application | 0.8 | 0.0-2.0 | 4.0 | 4.0-4.0 | Problem Solving | 1.3 | 0.0-4.0 | 3.2 | 2.0-4.0 |
| Use of Technology | 0.3 | 0.0-1.0 | 3.5 | 3.0-4.0 | Integration of Gen. Ed. | 0.3 | 0.0-1.0 | 3.1 | 2.0-4.0 |
| Rigorous Content | 0.3 | 0.0-1.0 | 3.8 | 3.0-4.0 | Assessment | 0.2 | 0.0-1.0 | 2.8 | 1.0-4.0 |
| Quality of Performance | 0.3 | 0.0-1.0 | 3.1 | 2.0-4.0 | Personal Qualities | 1.1 | 0.0-3.0 | 2.7 | 1.0-4.0 |
| | | | | | Diversity | 0.7 | 0.0-3.0 | 1.8 | 0.0-4.0 |

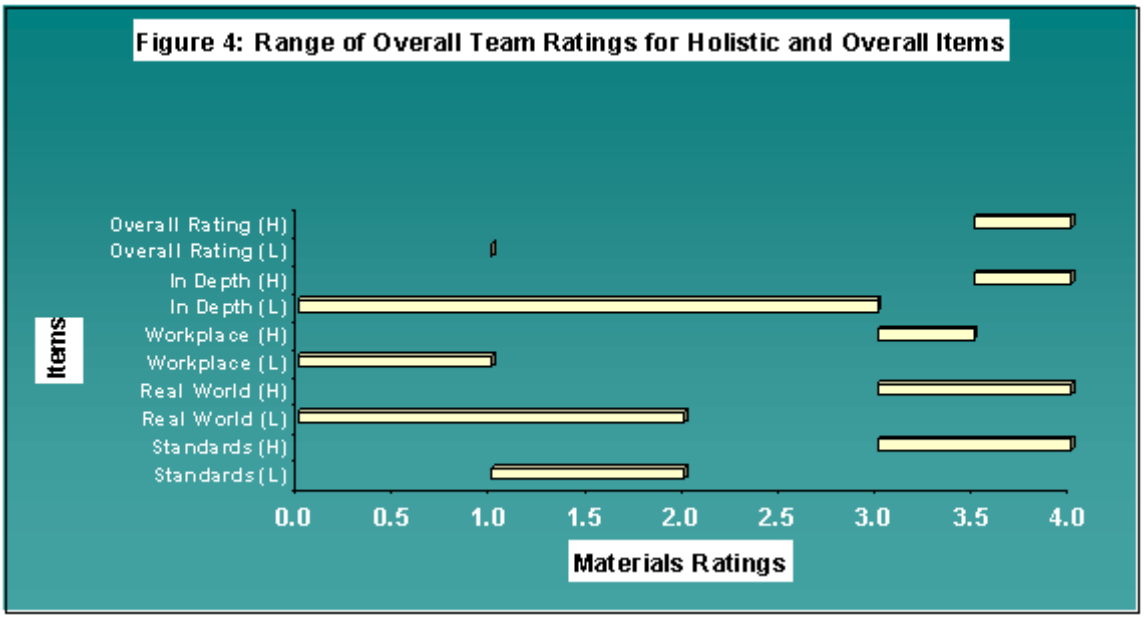



**Table 7: Contrast Between Highest and Lowest Rated Materials by Holistic and Overall Ratings**

| | Lowest 4 | | Highest 4 | |
|---|---|---|---|---|
| | **Mean** | **Range of Overall Team Ratings** | **Mean** | **Range of Overall Team Ratings** |
| Standards | 1.5 | 1.0-2.0 | 3.3 | 3.0-4.0 |
| Real World | 0.9 | 0.0-2.0 | 3.5 | 3.0-4.0 |
| Workplace | 0.6 | 0.0-1.0 | 3.2 | 3.0-3.5 |
| In Depth | 1.4 | 0.0-3.0 | 3.8 | 3.5-4.0 |
| Overall Rating | 1.1 | 1.0-1.0 | 3.6 | 3.5-4.0 |

**Findings**

Looking at the results from a glass half-full perspective, four-fifths of the materials were evaluated as adequate or better. Since in every case the proposals for development of curricular materials identifies current materials as inadequate (of poor quality), funded curricular development appears to be improving the state of materials available for instruction. Even in the situations where materials are judged not adequate, the materials have attributes that are likely viewed as improvements over their current situation.

Looking at the results from a glass half-empty perspective, these materials represent those thought to be the best by those developing materials. The fact that not all meet minimum levels to be judged adequate suggests that if all materials were evaluated, a much higher proportion would be judged inadequate.

NSF fully expects that not all materials development efforts will result in high quality products. Whether an upper limit of 4 of 5 materials being adequate is sufficiently good is a question for NSF to answer.

Many of the projects and centers that reported being involved in materials development on the 2002 survey did not provide materials for review for a variety of reasons including projects ending or changing, not having materials for review, and having materials that were not classroom based.

The categorizations reveal the diversity of the materials obtained and rated. This indicates that the ATE program is producing an assortment of materials and reaching a variety of industrial areas as well as funding categories, purposes, and institutions.

Rating for the materials in the various categorizations overlapped substantially, with each level of the category containing both strong and weak materials. Therefore, the categorizations cannot provide a strong basis for predicting quality of materials nor for funding decisions.

Despite the overlap of the ratings, there were some trends. Materials developed by projects and centers that received more funding and received it more recently received higher ratings. Additionally, materials developed for use outside of projects tended to be rated more highly than materials intended for use within projects. Materials of broader scope (use in a course or across several courses) also tended to receive higher ratings.

The ratings for the holistic items generally show the same pattern as the ratings for the overall item. In other words, the materials rated higher on the overall item were also rated higher on the holistic items. Of the holistic items, materials received the lowest ratings on the Workplace Competencies item. This is an important matter because workplace competency is a central concern of the ATE program. Yet, the rating is not unexpected, because this area was strongly perceived as a deficiency in previous curricular materials. Although one may hope for immediate correction of the situation with the new materials, it seems likely that development of materials to consistently meet this criterion will occur incrementally as materials are revised and improved.

The comparison of the highest and lowest rated materials shows that much of the difference in the ratings was due to differences in the ways the materials addressed industrial and content issues—such as quality performance, rigorous content, and relevant applications—as well as curricular issues, such as assessments and integration of general education skills.

***Recommendations***

NSF has changed its programmatic emphases since inception of this materials development effort. It now (2003) encourages only limited materials development efforts, ones that are intended for national dissemination. Also, the current program solicitation calls for establishing assurances of quality: "The proposal should describe the evidence to be accepted

that the goals of the materials have been achieved and also the means to provide the evidence." Both the limitation of proposals to develop materials for national dissemination and the call for evidence and evidence protocols are consistent with findings of this study. That consistency suggests that NSF is moving in the right direction with its modification of program solicitation guidelines.

NSF should continue to encourage projects and centers involved in materials development to hold themselves to high standards of development so that the materials produced will be of exceptional quality, not just adequate or good. For example, ATE program officers might require the use of the rubric developed here or other curriculum analysis/rating systems by ATE materials developers. Additionally, more contact could be encouraged between ATE material developers and material developers funded through other programs in the Directorate such as the Instructional Materials Development Program in Elementary, Secondary, and Informal Education.

NSF should encourage projects and centers involved in materials development to place more emphasis on quality performance, rigorous content, applications of concepts, integration of general education, and assessments. As one example of encouragement, the materials identified by this evaluation could be provided as models for others to follow. Additionally, exemplars of each separate area might be provided from existing ATE-developed materials to better define what is meant by high quality in each.

While the relationship between amount of funding and quality of materials is at best a tentative indicator, it does suggest that curriculum development is expensive and needs to be sufficiently funded if it is to achieve high quality materials. NSF should consider carefully the amount of money and time allocated to curriculum development. Although the data presented here do not indicate specifically how much money/time was spent on curriculum development, this recommendation is in accordance with discussions with the developers both through this project and at the ATE meetings where the PIs express surprise at the large amount of effort the development of quality materials requires.

NSF should consider limiting substantial materials development to sites planning to develop materials for external use. Materials development for local use might be folded into program improvement efforts.

# APPENDICES

Appendix I - ATE Materials Evaluation Time Line: Year 1
Appendix II – Collection of Materials
Appendices III and IIIa - ATE Material Reviewers and Credentials
Appendix IV – Development of the Rubric
Appendix V – Details of the Reviewing Process

## Appendix I
## ATE Materials Evaluation Time Line – Year 1

| Activity | August | September | October | November | December | January | February | March | April | May |
|---|---|---|---|---|---|---|---|---|---|---|
| **Rubrics** | Review literature and develop generic set of rubrics | | Develop specific set of rubrics for industry experts and education experts | | | Test and validate rubrics | | | Develop rubric training materials | |
| **Materials Collection & Evaluation** | Determine which ATE projects & centers developed materials | | Request & survey via e-mail for ATE developed materials<br><br>Short survey at annual PI meeting | | Send reminder e-mail and categorize the received materials | Call & send e-mail reminder<br><br>Categorize received materials | Use materials to pilot rubrics<br><br>Logistics for meeting | | Train reviewers on rubrics<br><br>Evaluate materials using rubrics | Data analys<br>Identi<br>the<br>"best"<br>mater |
| **Reviewers** | | | Request for reviewers at annual PI meeting | Generate potential reviewer list | | Contact reviewers and determine availability<br><br>Match materials with appropriate materials | | | Invite reviewers<br><br>Formal-ize contracts | |

## Appendix II
**Collection of Materials**

To: «PIPD_FN» «PIPD_LN», Principal Investigator

Date: October 16, 2002

Re: NSF-ATE # «NSF»: Request for Materials and Information

We here at the Evaluation project are once again requesting your assistance in the evaluation of the Advanced Technological Education (ATE) program. Specifically, this component of the evaluation is designed to examine the quality of the materials developed by ATE programs through its projects/centers.

Please consider all the materials your ATE project/center has developed and send us the "one" you consider to be the best by November 8, 2002. This "one" could be a module, a set of activities (e.g., lab exercises), a course, etc. Please send the material to the address below or let us know how we can obtain it (e.g., downloadable from a Web site) by replying to this e-mail.

Jonathan Keiser, ATE Research Assistant
Center for Applied Research & Education Improvement (CAREI)
275 Peik Hall
159 Pillsbury Drive S.E.
Minneapolis, MN 55455

We will be glad to cover any costs associated with the materials or mailing. If the cost will exceed $100, please contact me (Nanette Keiser) via this e-mail or at 269-387-5920 to discuss the amount you need prior to submitting a request for payment. To receive payment for the materials and/or costs to send them, please mail an invoice to me (Nanette) at The Evaluation Center, WMU, 401-B Ellsworth Hall Kalamazoo, MI 49008.

We also need your assistance in obtaining information for our study. Please respond to the following questions via email (click reply and type in your responses).

1. Please provide the name and contact information (email, phone) of someone you feel is well qualified to evaluate your material.

Name: _____

Contact information:

E-mail: _____
Phone: _____

2. Would the above person best be described as a (place an X next to the best answer):

____ user or potential user (e.g. instructor)
____ content expert (e.g. business/industry professional)
____ technical education expert
____ curriculum design expert

3. Please answer the following questions about the materials you are SENDING.

a) Formal title _____

b) Descriptive title _____

c) Author _____

d) Publisher (if applicable) _____

e) Please check any of the options below which describe the format of the material (Place an X next to all that apply)

| | | |
|---|---|---|
| _____ Textbook | _____ Pamphlet | _____ Website |
| _____ Workbook | _____ Diskette | _____ Other(s) (specify) |
| _____ Manual | _____ Computer | _____ |
| _____ CD-ROM | _____ Computer software | _____ |
| _____ Videotape | _____ Transparencies | _____ |
| _____ Audiotape | _____ Game | _____ |

f) Place an X next to the one option below which best describes the scope of the material.
____ material designed to supplement a single course
____ material that could comprise a single course
____ material that could comprise a complete year of a technical program
____ material that could comprise a complete multi-year technical program
____ material designed to pass a specific licensure requirement
____ other (specify) _____

g) Place an X next to the one option below which best describes the primary audience for the material.
____ elementary school students
____ high school students
____ first-year community/technical college students
____ second-year community/technical college students
____ upper-level college students
____ vocation/technical high school teachers
____ community/technical college instructor
____ other (specify) _____

h) What industry or technical discipline is the material associated with (i.e. computer networking,
electro-mechanical)? _____

4. We are also designing an assessment of community college technicians' problem solving skills for use by ATE projects and our evaluation team. Instructors often use problems or problem scenarios to help students learn.

a) Does your ATE project/center use problems or problem scenarios? _____

b) How do you define a problem?

c) Please give two examples (one simple, one complex) of problems presented to students in your program. Include the problem context if applicable.

d) What steps do instructors in your project/center ask students to use when solving problems?

5. Is your project willing to help with other evaluation processes? (Place as X next to all that apply)

_____ develop criteria to rate ATE developed material
_____ score another project's ATE material
_____ assist with problem solving activities (e.g. critique assessments, serve as a field test site)

If you have any questions regarding this particular study, please contact Jonathan Keiser at 612-624-2931 or via e-mail at jkeiser@dunwoody.edu.

Thank you for your assistance with this important phase of the ATE program evaluation.

Very truly yours,

Nanette Keiser
ATE Evaluation Project Co-PI/Project Manager

And on behalf of Arlen Gullickson, PI and Frances Lawrenz, Co-PI

## Appendix III
### ATE Materials Reviewers

In order to evaluate materials from both a pedagogical and workplace perspective, we sought expertise in the realm of education and industry. A database of 60 potential material reviewers and their contact information was generated in the following ways:

1. PI questionnaire responses
2. Requests for reviewers and suggestions at 2002 Annual PI meeting
3. Requests for reviewers suggestions of Advisory Committee
4. Textbook author and literature search
5. Industry search for experts

The specific industrial expertise sought was based on the curricular materials received. For instance, materials revolving around automated manufacturing led us to identify regional and national experts within this industry. We sent the developed list of reviewers to the ATE projects and centers that had provided materials to check for any potential conflicts of interest.

We e-mailed the 60 potential reviewers, asking them about their interest in reviewing ATE developed materials, requesting a short curriculum vita, and inquiring about their availability. Based on their experience we classified this list of potential reviewers as

1. Industry Experts
2. Curriculum Experts
3. Users—Expert Teachers/Instructors

We also cross-examined their credentials (based on their CV) with the collected ATE-developed materials to determine the reviewers that were "best fit" to the specific curricular materials. Reviewers were matched as closely as possible. So, if we had a Web-based mechanical engineering material, we had mechanical engineering industry experts, curricular experts in Web-based instruction (and often in the specific content area as well), and instructional experts with experience teaching Web-based mechanical engineering classes. We sent approximately 46 e-mails to this refined pool of candidates, asking about specific availability and potential conflicts of interest with the ATE materials they would be rating. Based on this information, 18 reviewers received formal invitations to rate the ATE developed materials. Each material was assigned 3 reviewers, 1 from each area of expertise. A list of the 18 reviewers' credentials is contained in Appendix IIIa.

# Appendix IIIa: Reviewer Credentials

| Name | Address | Phone# / E-Mail / Fax | Degree | Institution / Occupation | Expertise / Years Experience | ATE Content Area |
|---|---|---|---|---|---|---|
| Cynthia Hagley | 2306 E. 6th St. | Phn (218)726-8715 Alt. Phn (218) 726-8105 | MS. Aquatic Ecology/Limnology. | MS Sea Grant / Aquatic Ecologist/Educator | Biology/Aquatic Ecology | Industry: Environmental |
| | Duluth, MN 55812 | chagley@umn.edu | | Associate Prof. | 19 yrs experience | |
| | | Fax# (218) 726-6556 | | University of MN | | |
| Greg Geiser | 2200 E. Franklin Ave | Phn (612) 721-4444 | PhD. Curriculum and Instruction | Seward Inc. | Curriculum & Instruction | Curriculum: web based |
| | Minneapolis, MN 55404 | geiser@sewardinc.com | Instruction Design | | | |
| | | Fax: (612) 721-4445 | | | | |
| Helen Gilens | 121 Comeback Rd. | Phn (803) 892-2952 | M. Ed. Mathematic Education | National Resource Center for Engineering Technology, curriculum consultant - curriculum dissemination, implementation, and web site development | Curriculum Development Consultant | Curriculum: Welding, Physics, Engineering, Automotive |
| | Gilbert, SC. 29054 | jadane1114@sbcomm.net | Ed.D. Administration & Supervision | | 31 yrs experience | |
| Ilya Grinberg | 1300 Elmwood Ave | Phn (716) 878-4411 | PhD. Electrical Engineering | Associate Prof | Electrical Engineering systems, research and teaching 30 yrs industry & Teaching experience | Industry: Electrical |
| | Buffalo, NY 14222 | grinbely@buffalostate.edu | | Technology Dept | | |
| | | Fax: (716) 878-3033 | | Buffalo State College | | |
| James Greenan | 100 N. University St. | Phn (765) 494-7314 | Ph.D. | Professor | Curriculum & Instruction | Curriculum: Manufacturing |
| | West Lafayette, IN 47907 | jgreenan@purdue.edu | | Curriculum & Instruction | School of Education | |
| | | | | Purdue University | | |
| Jeff Keljik | 818 Dunwoody Blvd | Phn (612) 374-5800 | BA. Business Communication | Director of New Program Development | Electrical Construction & Maintenance | User: Electrical |
| | Minneapolis, MN 55403 | jkeljik@dunwoody.edu | Electrical Construction & Maintenance | Corporate Trainer for Electrical Systems and OSHA safety programs | 28 yrs experience | |
| | | | | Manager for all electrical construction and maintenance of Dunwoody campus | | |
| Jim Joswiak | 3216 South Canonero Way | Phn (208) 426-3205 | MS. Electrical Engineering | Instructor & Program Head | Solid state physics, IC Fabrication, Design & Simulation | User: Electrical |
| | Boise, ID 83709 | jjoswiak@boisestate.edu | | Boise State University | 17 yrs experience | |
| Jonathan Sanborn | 818 Dunwoody Blvd | Phn (612) 374-5800 | BA. Industrial Technology | Principle Instructor | Manufacturing & Design | Industry: Manufacturing |
| | Minneapolis, MN 55405 | jsanborn@dunwoody.edu | | Manufacturing & Design | 19 Years experience | |
| | | | | Dunwoody College | | |
| Joshua Phiri | 217 Quinby Circle | Phn: (843) 676-8641. Alt. Phn (843) 661-9226 | PhD. Physics | Instructor | Physics | User: Physics & Engineering |
| | Quinby, SC 29506 | Joshua.Phiri@fdtc.edu | | Physics | 20 yrs experience | |
| | | FAX: (843) 676-8641 | | Florence Darlington Technical College | | |
| Kenneth Chapman | 15060 Countyline Church Rd. | Phn (804) 448-9333 | BS. Chemical Engineering | Chemical Technician | Chemistry | User: Chemistry / Biotech |
| | Ruther Glen, VA 22546 | Kmc67@aol.com | MS. Adult Education | Principal Partner | 40 yrs experience | |
| | | Fax: (804) 448-9333 | | Cardinal Workforce Developers, LLC | | |
| Larry Loomis-Price | 3200 College Park Dr | Phn (936) 273-7080 | PhD. Bio-Inorganic Chemistry | Associate Professor | Chemistry / Bio-technology | Industry: Chemistry / Biotech |
| | The Woodlands, TX 77384 | llloomispr ice@lonestar.edu | Study of Siderophore Iron-Binding Mechanisms | Biology - Montgomery College | 20 yrs experience | |
| Leno Pedrotti | P.O. Box# 21888 | Phn (954) 772-9750 | PhD. Physics | Chief Scientist Emeritus | Physics | Industry: Physics & Engineering |
| | Waco, TX 76702 | pedrotti@cord.org | | CORD | 42 yrs experience | |
| | | Fax: (254) 772-2972 | | | | |
| Michael Luek | 6809 Yosemite Trail | Phn (865) 450-3151 | PhD. Educational Technology | Assistant Professor | Networking and Communication Systems | User: IT /Computers |
| | Knoxville, TN 37909 | jmlueke@pstcc.cc.tn.us | | Pellissippi State Tech Com College | 32 years experience | |
| Qetler Jenerud | 302 Buchtel Mall | Phn (330) 972-8403 | PhD. Education/Training & Development | Assistant Professor | Mid-media, Computers, IT & Education | Curriculum: Computers/IT |
| | Akron, OH 44325 | qetler@uakron.edu | | University of Akron | 19 yrs experience | |
| Reynaldo Martinez | 612 W. Bennett Dr | Phn (405) 744-7741 | PhD. Vocational Education | Associate Professor | Vocational Education | Curriculum: Physics / Engineering |
| | Stillwater, OK 74075 | rlm8804@okstate.edu | Teacher Education & Staff Development | Oklahoma State University | 28 yrs experience | |
| Timothy Pollock | 1250 Hennepin Ave #2403 | Phn (612) 936-7410 | BA. Business Administration | Proprietor/Independant Consultant | Networking Systems / Telecommunications | Industry: IT & Computers |
| | Minneapolis, MN 55403 | tim@pollock.net | | Pollock.net | 11 yrs experience | |
| Terry Murphy | 2004 Randolph Ave | Phn (651) 690-8877 | PhD. Educational Studies | Assistant Professor | Science Education | User: Environmental |
| | St. Paul, MN 55105 | gmurphy@stkate.edu | Science, Environmental Ed | College of St. Catherine | 13 yrs experience | |
| | | Fax: (651) 690-8651 | | | | |
| Truman Schwartz | 1600 Grand Ave | Phn (651) 696-6042 | PhD. Physical Chemistry | Professor | Chemistry & Chemical Education | Curriculum: Chemistry / Biotech |
| | St. Paul, MN 55105 | schwartz@macalester.edu | | Macalester College | 47 yrs experience | |
| | | Fax: (651) 696-6499 | | | | |

## Appendix IV
### Development of the Rubric

A review of technical and vocational education and assessment literature identified the critical elements needed to assess the quality of technical education curriculum. A listing of the significant references that provided the theoretical framework is provided at the end of this appendix. This framework is largely derived from Finch and Crunkilton's (1999) work on curriculum development, which distinguishes the characteristics of vocational and technical education from the rest of the education milieu. Accordingly, the rubric favors a learner-oriented curriculum that is justified by vocational demands and is focused on developing competencies identified as necessary for success in the world of work. Wiggins' (1993, 1998) model of authentic assessment was seen as particularly well-suited to technical education. As such, the rubric assesses both the industrial value and pedagogical soundness of the materials.

Industrial value is determined by how closely the materials reflect specific industry standards and practices, to what extent they engage learners in authentic professional tasks, and how well they develop the personal qualities necessary for the workplace. The pedagogical soundness is determined by how well the materials center curriculum, instruction, and assessments on the needs of the learner and to what extent the learning objectives develop competencies necessary to succeed in the world of work. In light of these dual objectives, the rubric had multiple sections. The first sections of the rubric assess these different aspects separately, whereas the third and fourth sections of the rubric consider them simultaneously. Having four parts to the rubric provides a measure of internal consistency. The rubric was devised to be used by teams of experts who could more accurately assess the dual nature of technical education curriculum and add validity.

*Construction and Refinement*

Based on the theoretical model, the first draft of the rubric was developed by the assessment specialists on the ATE evaluation team. This first draft was then tried out on actual curricular materials similar to those used in ATE projects. This resulted in a second draft based on the weaknesses identified through the application. Through this iterative process of critique and application, a rubric with several parts was developed that could be used to assess curricula designed for technician education in a wide range of technical fields. Improvements were made in wording, in rating scales, numbers of items, etc. It was decided that a series of "yes/no" questions should precede the ratings to assure that raters would attend to this type of evidence in the materials.

This refined draft of the rubric was sent to the ATE evaluation project's Advisory Committee and NSF program officers for review. The committee is a nine member team composed of technical education and evaluation experts. The draft rubric was provided to the committee members, who were given the opportunity to actually use it to rate a piece of curriculum similar to ATE materials included in our sample. Although the Advisory Committee and NSF viewed the rubric as comprehensive, as fitting ATE needs, and as asking the right questions about quality, they also made suggestions for improvements. We systemically considered and applied each comment and suggestion to the entire rubric. Suggestions included alignment with STEM, within the items, and with current and future industry needs; better structure within the rubric; more careful wording of the items; better consideration of diversity and assessment; and clearer

explanations of the topics. Each suggestion and comment was carefully considered and modifications made.

This revised draft was then used by three science/technology education experts to independently rate three different materials. The reviewers then met to discuss their ratings and interpretations and ease of use and clarity of the rubric. This resulted in further minor modifications in wording, definitions, instructions, consistency, etc.

The polished draft of the rubric was e-mailed to each PI who sent materials to us for evaluation. We asked for their feedback and guaranteed their anonymity in the evaluation process. We also agreed to provide them with a summary of the ratings their material received.

This process of development and refinement stretched over several months and provided useful refinement of the original rubric. As can be seen below, the rubric has four parts, with each part serving a different purpose. The first part is an industrial review containing five items; the second is a curriculum, instruction, and assessment view containing six items; the third is a holistic view combining the technological and pedagogical reviews containing four items; and the fourth part is a single overall rating of the quality of the material. All items are rated on a 0-4 basis with an NA/Don't Know option as well. A 0 means the material does not do whatever the item specifies, a 1 means the material is weak at doing it, a 2 means adequate, a 3 means good, and a 4 means excellent.

References

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Wiggins, G. (1998). *Educative assessment: Designing assessments to inform and improve student performance*. San Francisco: Jossey-Bass.

**Reviewer Name: _____**

**Material Name & NSF #: _____**

## Rubrics for Assessing the Quality of ATE Developed Materials

**OVERVIEW:**
These rubrics are for the evaluation of materials developed by Advanced Technological Education (ATE) projects and centers. Elements of quality were identified in a literature review and an analysis of the ATE program evaluation issue papers. These quality indicators were summarized and mapped to the rubric categories. There are three types of ratings: specific, holistic and overall.

***The SPECIFIC RATINGS should be done first.***

- Reviewers are to answer only the set of items related to their expertise, either "industry or content specialist" or "curriculum, instruction, & assessment specialist."
- Reviewers are asked to answer some yes or no questions, provide a rating of quality, and give evidence to support the ratings.

***The second set of items is HOLISTIC RATINGS***.

- These are broad and are meant to capture the general quality of the materials.
- These questions are to be answered by all the reviewers.

***The third item is an OVERALL RATING.***

- This is a summary assessment of the effectiveness of the materials in helping students learn the knowledge and skills and/or practices needed to be successful in the technical workplace.
- Reviewers are asked to provide both a rating and the evidence to support the rating.
- This question is to be answered by all reviewers.

***Rating Scale***

- All items are rated on a five-point scale from 0 to 4.
- Zero means none of the characteristics described in the question are reflected in the materials.
- Four indicates that all of the characteristics described in the question are reflected in the material.
- The NA means "Not Applicable" and DK means "Don't Know." These should only be used in rare circumstances.

**THANK YOU FOR YOUR HELP!**

**SPECIFIC RATINGS**

INDUSTRY AND CONTENT SECTION (**<u>*only* answered by industry or content specialists</u>**)

***Under each roman numeral, please answer the Yes or No questions first by circling yes or no for each item***. *They are intended to help you reflect on specific elements of the materials and to help you understand the intent of the rubric question.* ***They are meant to be representative of some important elements but <u>not</u> inclusive of all.***

## I. Alignment of Materials with Workplace

*Do the materials reflect accurate industry and professional practices?* *Yes or No*
*Do the materials reflect current industry and professional practices?* *Yes or No*
*Do the materials reflect anticipated industry and professional practices?* *Yes or No*
*Do the materials reflect concepts which are essential to the industry?* *Yes or No*

1. To what extent do the learning objectives align with appropriate industry standards and practices?

| | NA/DK | | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|

0: Materials *do not* align learning objectives with appropriate industry standards and practices.
1: Materials are *weak* at aligning learning objectives with appropriate industry standards/practices.
2: Materials are *adequate* at aligning learning objectives with appropriate industry standards/practices.
3: Materials are *good* at aligning learning objectives with appropriate industry standards/practices.
4: Materials are *excellent* at aligning learning objectives with appropriate industry standards/practices.

**Describe the evidence that supports your rating:**

_____

_____

## II. Application of Knowledge

*Do the materials require students to apply knowledge?* *Yes or No*
*Do the materials require students to perform a task?* *Yes or No*

2. To what extent do the materials make students demonstrate the knowledge and skills associated with industry standards and practices?

| | NA/DK | | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|

0: Materials *do not* demonstrate knowledge and skills associated with industry standards.
1: Materials are *weak* at demonstrating knowledge and skills associated with industry standards.
2: Materials are *adequate* at demonstrating knowledge and skills associated with industry standards.
3: Materials are *good* at demonstrating knowledge and skills associated with industry standards.
4: Materials are *excellent* at demonstrating knowledge and skills associated with industry standards.

**Describe the evidence that supports your rating:**

_____

_____

### III. Realistic Use of Technology

*Do the materials require students to use technology (e.g., tools, equipment, software)?* *Yes or No*
*Do the materials explain why technology or certain equipment is used?* *Yes or No*
*Do the materials require students to fix or troubleshoot equipment?* *Yes or No*
*Do the materials require students to use safety procedures?* *Yes or No*

3. To what extent do the materials use technology? That is, do the materials use technology (e.g., tools, instruments, machines, hardware, software) in the same way as it is actually used in industry practices?

| | NA/DK | | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|

0: Materials *do not* use technology in a realistic way.
1: Materials are *weak* at using technology in a realistic way.
2: Materials are *adequate* at using technology in a realistic way.
3: Materials are *good* at using technology in a realistic way.
4: Materials are *excellent* at using technology in a realistic way.

**Describe the evidence that supports your rating:**

_____

_____

### IV. 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? Is there a better way to do this?* *Yes or No*

4. 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.

**Describe the evidence that supports your rating:**

_____

_____

### V. 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*

5. 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

**Describe the evidence that supports your rating:**

_____

_____

## SPECIFIC RATINGS

CURRICULUM, INSTRUCTION, & ASSESSMENT SECTION
(****only*** answered by the curriculum, instruction and assessment specialists****)

***Please answer the Yes or No questions first by circling yes or no for each item.*** *They are intended to help you reflect on specific elements of the materials and to help you understand the intent of the rubric question.* ***They are meant to be representative of some important elements but not inclusive of all.***

### I. 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 (e.g., grade, student population or content standard)?* *Yes or No*

*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*

1. 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.

**Describe the evidence that supports your rating:**

_____

_____

## II. 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*

2. 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.

**Describe the evidence that supports your rating:**

_____

_____

### III. 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*

3. 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.

**Describe the evidence that supports your rating:**

_____

_____

### IV. Assessment

*Are the assessments closely aligned with the learning objectives?* *Yes or No*

*Do the required activities and assessments have more than one correct answer?* *Yes or No*

*Do the assessments provide feedback to the student and an opportunity to improve performance?* *Yes or No*

*Do the assessments integrate specific professional or industry skills?* *Yes or No*

*Do the assessments allow students to demonstrate their understanding and abilities in different ways?* *Yes or No*

*Do the assessments have activities that use real world situations?* *Yes or No*

*Do the assessments provide feedback to the instructor that could be used to improve the materials?* *Yes or No*

4. To what extent do the assessments or required activities measure the adequacy of the student's knowledge and skills required in the workplace?

| | NA/DK | | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|

0: The assessments do not measure the knowledge and skills required in the workplace.
1: Assessments are *weak* at measuring the knowledge and skills required in the workplace.
2: Assessments are *adequate* at measuring the knowledge and skills required in the workplace.
3: Assessments are *good* at measuring the knowledge and skills required in the workplace.
4: Assessments are *excellent* at measuring the knowledge and skills required in the workplace.

**Describe the evidence that supports your rating:**

_____

_____

## V. 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*

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.

| | 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.

**Describe the evidence that supports your rating:**

_____

## VI. 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*

6. 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.

**Describe the evidence that supports your rating:**

_____

_____

**Material Name & NSF#:** _____
**Group Reviewer's Names:** _____

## HOLISTIC RATINGS (**answered by *all* reviewers**)

1. **Industry Standards & Practices:** Materials should clearly reflect learning objectives that are based on current business, industry and technology standards and practices.

Linked: Industry& Content rubrics 1, 2, 3, 4 & 5

| | NA/DK | | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|

0: The materials *do not* reflect any industry standards and practices.
1: The materials are *weak* at reflecting industry standards and practices.

2: The materials are *adequate* at reflecting industry standards and practices.
3: The materials are *good* at reflecting industry standards and practices.
4: The materials are *excellent* at reflecting industry standards and practices.

**2. Real World Curriculum:** Materials should engage learners in ways to help them understand the reality of the profession they seek. Instruction should be related to workplace needs. Materials should use tasks that are real activities that people perform while "on the job".

Linked: Industry& Content rubrics 1, 2, 3 & 5
Curriculum, Instruction, & Assessment rubrics 1 &4

| | NA/DK | | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|

0: The materials *do not* engage the learner in real world tasks.
1: The materials are *weak* at engaging the learner in real world tasks.
2: The materials are *adequate* at engaging the learner in real world tasks.
3: The materials are *good* at engaging the learner in real world tasks.
4: The materials are *excellent* at engaging the learner in real world tasks.

**3. Workplace Competencies:** How well do the materials enable students to develop the high performance skills needed to succeed in a high performance workplace? The Secretary's Commission on Achieving Necessary Skills (SCANS) was appointed by the Secretary of Labor to determine the skills people need to succeed in the world of work. According to the SCANS Report high performance workers need a solid foundation in basic literacy (reading, writing, listening and speaking), computational skills, applying technology, and understanding social organizational and technological systems. They also need thinking skills to put knowledge and resources to work and the personal qualities that make them dedicated, reliable and able to work with others.

Linked: Industry& Content rubrics 3, 4 & 5
Curriculum, Instruction, & Assessment rubrics 2, 3, 4, & 5

| | NA/DK | | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|

0: The materials *do not* develop workplace skills.
1: The materials are *weak* at developing workplace skills.
2: The materials are *adequate* at developing workplace skills.
3: The materials are *good* at developing workplace skills.
4: The materials are *excellent* at developing workplace skills.

4. **Access to In Depth Understanding:** How well do the materials allow all learners to acquire in depth understanding? Such practices include instructional strategies that actively engage students and allow them to learn in ways consistent with their preferences. The materials also require students to synthesize, generalize and evaluate information and to develop complex understandings of the content by exploring connections and relationships. In addition, materials that allow access to in-depth understanding are also well organized, easy to follow and contain assessments and activities that are aligned with the content.

Linked: Curriculum, Instruction, & Assessment rubrics 1, 2, 3, 4, 5 & 6

| | NA/DK | | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|

0: The materials *do not* support in depth understanding.
1: The materials are *weak* at supporting in depth understanding.
2: The materials are *adequate* at supporting in depth understanding.
3: The materials are *good* at supporting in depth understanding.
4: The materials are *excellent* at supporting in depth understanding.

## OVERALL RATINGS (**answered by *all* reviewers**)

Please rate the effectiveness of the materials in having students learn the knowledge and skills or practices needed to be successful in the technical workplace. Select the description that best characterizes your overall assessment. ***This rating is not intended to be an average of all the previous ratings, but your overall judgment of quality and likely impact of the materials. Please describe the evidence that supports your rating in the space provided.***

To what extent will the materials help students learn the knowledge and skills or practices needed to be successful in the technical workplace?

| | NA/DK | | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|

**0: The materials *will not* help students learn knowledge and skills or practices needed to be successful in the technical workplace.**
**1: The materials *will be weak* at helping students learn knowledge and skills or practices needed to be successful in the technical workplace.**
**2: The materials *will be adequate* at helping students learn knowledge and skills or practices needed to be successful in the technical workplace.**
**3: The materials *will be good* at helping students learn knowledge and skills or practices needed to be successful in the technical workplace.**

**4: The materials *will be excellent* at helping students learn knowledge and skills or practices needed to be successful in the technical workplace.**

**Describe the evidence that supports your rating:**

_____

_____

_____

_____

## Appendix V
### Details of the Reviewing Process

Each material was rated four times, once by each type of expert (i.e., industrial, curricular, and instructional) and once by the team. Reviewers were assigned 3 to 7 materials depending on how many fell into their area of expertise. Two materials were rated by fewer than three raters because of the restricted nature of the content. The team ratings were done after each team member completed his or her individual rating and after the team had the opportunity to meet and discuss the material. For a given material, the industrial expert reviewer would complete the industry part of the rubric, the holistic part, and the overall part. The curricular expert reviewer would complete the curricular part of the rubric, the holistic part, and the overall part. The instructional expert reviewer would complete either the curricular or the industry part of the rubric depending on where s/he felt most expert, the holistic part, and the overall part. Then the three reviewers would meet and discuss their individual ratings and provide team ratings for the holistic and the overall items on the rubric. Examining the various combinations of these different ratings provides evidence of the consistency of individual raters within materials as well as consistency across raters. Since all raters were trained, it is assumed that one group was not "harder raters" than another group. This assumption was further strengthened by the fact that several of the reviewers were in different teams. In other words, the set of three reviewers was not always the same depending on the specific nature of the material. For example, a mechanical engineering material on CD-ROM or Web would be rated by a different group than a mechanical engineering material in text because the curricular expert for the CD-ROM would be one with instructional technology expertise.

Interrater, intrarater, and intragroup reliabilities were calculated. These show strong agreement. This agreement lends credence to the consistency of the reviewers, the quality of the reviewer training, and the understandability of the rubrics. It is difficult to separate which of the preceding activities are most indicative of the high agreements within and across raters since all are requirements of high reliability within and across raters. The validity of the rubrics is supported by the agreement of the various experts in their discussion and the team ratings. These experts from different perspectives came to substantial agreement on the overall quality of the materials. It would seem then that the ratings reflected the actual quality of the materials and hence that the rubrics were valid. All data were used in the calculations, so numbers of ratings can vary depending on the raters' use of the NA/Don't Know options.

*Interrater Reliability*

The interrater reliabilities were calculated for the four holistic rubric items and the overall rubric item. These scores were calculated by tallying each instance reviewers were in perfect agreement, within one point of agreement, two points of agreement . . . etc., for a particular material. The interrater reliabilities for the holistic and overall rubrics suggest that all reviewers, despite their varying expertise, interpreted the rubrics in the same way. On average, 80 percent of the reviewers were within one point of agreement. The following details the interrater reliabilities.

**Interrater Reliability – Holistic and Overall Rubric Items**
**Averaged % Agreement Between Each Rating**

| **1. Industry Standards &** | **Within this many points** |
|---|---|

**Practices**

| | perfect | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Rater scores | 22 | 34 | 11 | 3 | 0 |
| % Agreement | 31% | 49% | 16% | 4% | 0% |

**2. Real World Curriculum**

**Within this many points**

| | perfect | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Rater scores | 28 | 40 | 5 | 4 | 0 |
| % Agreement | 36% | 52% | 6% | 5% | 0% |

**3. Workplace Competencies**

**Within this many points**

| | perfect | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Rater scores | 25 | 35 | 13 | 2 | 0 |
| % Agreement | 33% | 47% | 17% | 3% | 0% |

**4. Access to In-Depth Understanding**

**Within this many points**

| | perfect | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Rater scores | 29 | 32 | 15 | 3 | 0 |
| % Agreement | 37% | 41% | 19% | 4% | 0% |

**0verall Rating**

**Within this many points**

| | perfect | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Rater scores | 24 | 36 | 12 | 0 | 0 |
| % Agreement | 33% | 50% | 17% | 0% | 0% |

*Intragroup Reliability*

The intragroup reliabilities were calculated for the four holistic rubric items and the overall rubric item. These scores were calculated by tallying each instance individual reviewers were in perfect agreement, within one point of agreement, within two points of agreement . . . etc., with the team rating for a particular material. As can be seen in the table below, the intragroup reliabilities suggest a high degree of internal consistency between the three individual ratings and the group rating.

**Intragroup Reliability – Holistic and Overall Rubric Items**
**Averaged % Agreement Between Individual Ratings and Team Rating**

**1. Industry Standards**
**&**
**Practices** **Within this many points**

| | perfect | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Rater scores | 46 | 25 | 8 | 0 | 0 |
| % Agreement | 58% | 32% | 10% | 0% | 0% |

**2. Real World Curriculum**

| | Within this many points | | | | |
|---|---|---|---|---|---|
| | **perfect** | **1** | **2** | **3** | **4** |
| Rater scores | 45 | 30 | 7 | 1 | 0 |
| % Agreement | 54% | 36% | 8% | 1% | 0% |

**3. Workplace Competencies**

| | Within this many points | | | | |
|---|---|---|---|---|---|
| | **perfect** | **1** | **2** | **3** | **4** |
| Rater scores | 44 | 35 | 4 | 1 | 0 |
| % Agreement | 52% | 42% | 5% | 1% | 0% |

**4. Access to In-Depth Understanding**

| | Within this many points | | | | |
|---|---|---|---|---|---|
| | **perfect** | **1** | **2** | **3** | **4** |
| Rater scores | 48 | 28 | 8 | 0 | 0 |
| % Agreement | 57% | 33% | 10% | 0% | 0% |

**0verall Rating**

| | Within this many points | | | | |
|---|---|---|---|---|---|
| | **perfect** | **1** | **2** | **3** | **4** |
| Rater scores | 45 | 28 | 5 | 0 | 0 |
| % Agreement | 58% | 36% | 6% | 0% | 0% |

Average intragroup correlations were also calculated for each of the holistic ratings with the overall rubric rating. As shown in the table below, these correlations also suggest a high degree of internal consistency between the three individual ratings and the group rating.

**Average Intragroup Correlations**

| 1. Industry Standards & Practices | 2. Real World Curriculum | 3. Workplace Competencies | 4. Access to In-Depth Understanding | Overall |
|---|---|---|---|---|
| 0.68 | 0.80 | 0.76 | 0.79 | 0.79 |

*Intrarater Reliability*

The intrarater reliabilities were calculated for each reviewer. These scores were calculated by examining the agreement between the specific RATINGS and the corresponding holistic RATINGS and the average of the holistic RATINGS with the overall RATINGS. The intrarater

reliabilities suggest that reviewers were consistent with themselves. Appendix Va contains the intrarater reliabilities for each reviewer. As can be seen in the table below, the intrarater reliabilities averaged across all reviewers suggests a high degree of internal consistency for the evaluation on the whole. We also calculated and compared the intrarater reliabilities for the industry-oriented reviewers and the curriculum-oriented reviewers. As can be seen in the table below, the strong similarity in scores between these two sets of reviewers suggests that the rubrics are internally consistent from both an industry and a pedagogical perspective.

**Intrarater Reliability Averages**
**Averaged % Agreement Across Each Reviewer's RATINGS**

**All reviewers (20)***

| | Within this many points | | | | |
|---|---|---|---|---|---|
| | **perfect** | **1** | **2** | **3** | **4** |
| # Rater scores | 211 | 113 | 17 | 1 | 0 |
| % Agreement | 62% | 33% | 5% | 0% | |

**Industry reviewers (9)**

| | Within this many points | | | | |
|---|---|---|---|---|---|
| | **perfect** | **1** | **2** | **3** | **4** |
| # Rater scores | 88 | 49 | 9 | 0 | 0 |
| % Agreement | 60% | 34% | 6% | | |

**Curriculum reviewers (11)**

| | Within this many points | | | | |
|---|---|---|---|---|---|
| | **perfect** | **1** | **2** | **3** | **4** |
| # Rater scores | 123 | 64 | 8 | 1 | 0 |
| % Agreement | 63% | 33% | 4% | 1% | |

* Note: 2 reviewers served dual capacities, rating some materials as an industry expert and other materials as a user (teaching) expert. Because each capacity was counted separately, it artificially inflated the total numbers of reviewers from 18 to 20.

# Appendix Va. Intrarater Reliabilities

## Intrarater Reliabilities
## Averaged % Agreement Within Each Reviewer

| Reviewer 1 | Within this many points | | | | |
|---|---|---|---|---|---|
| | perfect | 1 | 2 | 3 | 4 |
| Rater scores | 15 | 5 | 0 | 0 | 0 |
| % Agreement | 75% | 25% | 0% | 0% | 0% |

| Reviewer 2 | Within this many points | | | | |
|---|---|---|---|---|---|
| | perfect | 1 | 2 | 3 | 4 |
| Rater scores | 17 | 1 | 2 | 0 | 0 |
| % Agreement | 85% | 5% | 10% | 0% | 0% |

| Reviewer 3 | Within this many points | | | | |
|---|---|---|---|---|---|
| | perfect | 1 | 2 | 3 | 4 |
| Rater scores | 9 | 8 | 3 | 0 | 0 |
| % Agreement | 45% | 40% | 15% | 0% | 0% |

| Reviewer 4 | Within this many points | | | | |
|---|---|---|---|---|---|
| | perfect | 1 | 2 | 3 | 4 |
| Rater scores | 8 | 10 | 2 | 0 | 0 |
| % Agreement | 40% | 50% | 10% | 0% | 0% |

| Reviewer 5 | Within this many points | | | | |
|---|---|---|---|---|---|
| | perfect | 1 | 2 | 3 | 4 |
| Rater scores | 9 | 7 | 0 | 0 | 0 |
| % Agreement | 56% | 44% | 0% | 0% | 0% |

| Reviewer 6 | Within this many points | | | | |
|---|---|---|---|---|---|
| | perfect | 1 | 2 | 3 | 4 |
| Rater scores | 8 | 3 | 1 | 0 | 0 |
| % Agreement | 67% | 25% | 8% | 0% | 0% |

| Reviewer 7 | Within this many points | | | | |
|---|---|---|---|---|---|
| | perfect | 1 | 2 | 3 | 4 |
| Rater scores | 17 | 7 | 0 | 0 | 0 |

| | | | | | |
|---|---|---|---|---|---|
| % Agreement | 71% | 29% | 0% | 0% | 0% |

| **Reviewer 8** | **Within this many points** | | | | |
|---|---|---|---|---|---|
| | **perfect** | **1** | **2** | **3** | **4** |
| Rater scores | 9 | 11 | 4 | 0 | 0 |
| % Agreement | 38% | 46% | 17% | 0% | 0% |

| **Reviewer 9** | **Within this many points** | | | | |
|---|---|---|---|---|---|
| | **perfect** | **1** | **2** | **3** | **4** |
| Rater scores | 10 | 9 | 1 | 0 | 0 |
| % Agreement | 50% | 45% | 5% | 0% | 0% |

| **Reviewer 10** | **Within this many points** | | | | |
|---|---|---|---|---|---|
| | **perfect** | **1** | **2** | **3** | **4** |
| Rater scores | 6 | 6 | 0 | 0 | 0 |
| % Agreement | 50% | 50% | 0% | 0% | 0% |

| **Reviewer 11** | **Within this many points** | | | | |
|---|---|---|---|---|---|
| | **perfect** | **1** | **2** | **3** | **4** |
| Rater scores | 10 | 9 | 1 | 0 | 0 |
| % Agreement | 50% | 45% | 5% | 0% | 0% |

| **Reviewer 12** | **Within this many points** | | | | |
|---|---|---|---|---|---|
| | **perfect** | **1** | **2** | **3** | **4** |
| Rater scores | 10 | 6 | 0 | 0 | 0 |
| % Agreement | 63% | 38% | 0% | 0% | 0% |

| **Reviewer 13** | **Within this many points** | | | | |
|---|---|---|---|---|---|
| | **perfect** | **1** | **2** | **3** | **4** |
| Rater scores | 13 | 9 | 2 | 0 | 0 |
| % Agreement | 54% | 38% | 8% | 0% | 0% |

| **Reviewer 14** | **Within this many points** | | | | |
|---|---|---|---|---|---|
| | **perfect** | **1** | **2** | **3** | **4** |
| Rater scores | 16 | 4 | 0 | 0 | 0 |
| % Agreement | 80% | 20% | 0% | 0% | 0% |

| Reviewer 15 | Within this many points | | | | |
|---|---|---|---|---|---|
| | perfect | 1 | 2 | 3 | 4 |
| Rater scores | 14 | 2 | 0 | 0 | 0 |
| % Agreement | 88% | 13% | 0% | 0% | 0% |

| Reviewer 16 | Within this many points | | | | |
|---|---|---|---|---|---|
| | perfect | 1 | 2 | 3 | 4 |
| Rater scores | 7 | 5 | 1 | 0 | 0 |
| % Agreement | 54% | 38% | 8% | 0% | 0% |

| Reviewer 17 | Within this many points | | | | |
|---|---|---|---|---|---|
| | perfect | 1 | 2 | 3 | 4 |
| Rater scores | 10 | 2 | 0 | 0 | 0 |
| % Agreement | 83% | 17% | 0% | 0% | 0% |

| Reviewer 18 | Within this many points | | | | |
|---|---|---|---|---|---|
| | perfect | 1 | 2 | 3 | 4 |
| Rater scores | 18 | 5 | 0 | 1 | 0 |
| % Agreement | 75% | 21% | 0% | 4% | 0% |