

MatEd Gap Analysis: Currently Available Module Information

National Resource Center for Materials Technology Education
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In formulating this report, 404 modules listed on the activity sheets and labs on the MatEd web site were reviewed relative to content and level. Each module was evaluated for area, level and competencies focus. In general, modules are available in many of the areas of identified core competencies. Most are at the introductory or intermediate level, and focus on metals and composites. A summary spreadsheet is attached in which the sets of modules are matched to the competency areas they cover, each with grade level indicated. Details of the data sets reviewed, the area classification system and the module level classification are attached in Appendix 1.

In general, the modules reviewed relate to the core competency areas, but are not necessarily focused specifically on the core competencies themselves. The modules do represent an excellent collection of ideas that can be adapted and re-focused on specific competencies, and as such provide excellent ideas for focused modules. Unfortunately, not all of the sources are generally available, as is noted in Appendix 2. In some of these cases, MatEd may be able to market these modules for the authors.

Gap areas not sufficiently covered by the initial data sets are indicated in the center column of the spreadsheet, with green indicating important gaps, which black indicated critical gaps. This evaluation takes into account both the core competency study's "critical" areas and a qualitative evaluation of the quality and quantity of available modules.

Using this information, modules have been solicited, while others have been re-focused and adapted to provide curriculum in the gap areas. This constitutes the set of reviewed and classroom tested modules currently under development through the MatEd program. The initial set of modules in this category, indicated by "R" in the spreadsheet, are beginning to provide coverage in the most needed areas. This process will continue to provide a wider scope and more depth in critical core competency areas, especially those in areas 16 through 19.

An incomplete list of potential sources not yet explored is given in Appendix 3. This includes a wide variety of web sites and conference proceedings that undoubtedly contain curricula that could be of use to MatEd, along with material available from MRSEC and related projects, some of whom have been solicited as program partners. These sources need to be fully reviewed, cataloged and classified relative to modules related to the core competencies.

Areas not specifically included in the core competency list but which are important materials technology areas, and of which at least some technicians need to be aware are given in Appendix 4. In some cases, these areas can be added through collaborative work with other projects.

Next steps in the gap analysis process include

- Further review of modules available from sources noted
- Complete cataloging of all available modules relative to core competency area
- Identification and/or re-focusing of specific modules on "critical" competencies

APPENDIX 1: MODULES REVIEWED AND CLASSIFICATION SYSTEM USED

Modules reviewed:

- A. “Materials Science and Technology” curriculum developed by Pacific Northwest National Laboratory (PNNL)
- B. “Materials Science Technology curriculum, Energy Concepts, Inc (ECI)
- C. “CITE Manufacturing Technology Modules (CITE), Ball State University.
- D. “Materials World Modules,” Northwestern University (MWM)
- E. “Materials Science and Technology” workshop modules, University of Illinois (MAST)
- F. “Manufacturing Technology Advisory Group,” Washington State (MTAG)
- G. “Macrogalleria,” Cybergalleria of Polymer Fun, Southern Mississippi University
- H. MatEd Introductory Materials Laboratories
- R. MatEd Peer Reviewed and Classroom Tested Modules

Technical area classification system:

- M Metals
- E Ceramics
- P Plastics/polymers
- C Composites
- L Electronic/optical materials
- W Wood
- T Concrete
- G General/multi-material

Module level classification system:

- I Introductory--suitable for HS and up for an intro, grades 8 - 16
- N Intermediate--for advanced HS and up, grades 11 - 16
- A Advanced—community college, tech college, university level undergrad

APPENDIX 2. LIMITATIONS OF THESE MODULE SETS FOR GENERAL USE:

The question of availability of the module sets reviewed above depends on the set. Some are copyrighted and some are out of print, while others are currently available on the internet. Here is the current situation relative to these resources.

- A. PNNL curriculum modules are not copyrighted and are available in hard copy from PNNL; The EMTECH project at Edmonds created a disc with these modules on CD, which has been available from the Edmonds bookstore but now are on-line.
- B. ECI is available only in print form from ECI; there is little chance that we could obtain general access to individual modules.
- C. CITE modules may or may not be available—MatEd has a hard copy set but the overall set is no longer available from Ball State. Individual may be able to release these modules for general use, but need to be contacted for terms.
- D. Materials World Modules, an NSF project, are copyrighted and available only from the source, and only in hard copy in sets.
- E. MAST is available on the web, but the locator sheets indicate a cost of \$40 each. The status needs to be clarified. We need to determine if MatEd could market these modules for them.
- F. MTAG is available from MTAG; also listed at Sinclair. We need to determine if MatEd could market these modules for them.
- G. Macrogalleria is a readily accessible web site, open for use.
- H. MatEd labs are written specifically for general introductory use.
- R: Reviewed and classroom tested modules under development

APPENDIX 3. SOURCES NOT YET EXPLORED:

A wide variety of potential sources of materials modules are still to be explored. This is a list of some of the possibilities with more to follow:

Modules available from Materials Research Science and Engineering Centers and similar projects need detailed exploration.

Macrogalleria, a polymers site included in MatEd's activity locator sheets, needs to be explored in detail along with other resources related to polymers.

A variety of modules are already listed at other ATE center sites. These need to be reviewed for materials-related modules:

- MATEC on semiconductors

- Sinclair on manufacturing and engineering materials

Modules and courses available from professional groups such as SME, ASM, NACE, SAMPE, AWS, etc., need to be reviewed for applicability to MatEd.

Other sources on the web that need to be found and reviewed.

APPENDIX 4. OTHER GAP AREAS:

1. Electronic properties of materials—some electronic properties modules are included above, but not to the extent that these materials are important in technology. Those that exist are in categories
 - 7.0 thermal, physical and other properties
 - C: optical effects, weather effects
 - D: smart sensors
 - E: electrical resistance of light bulb filament
 - 7.0 emerging materials technologies

D: biosensors, smart sensors

2. Biomaterials except for D1 the biodegradable materials module.
3. Nanomaterials technology, except where this area is an extension of existing activities to a nano level.
4. MEMS (microelectromechanical systems).
5. Corrosion, a very important limitation on materials life expectancy.
6. Welding and joining may be covered by the Weld-Ed NSF ATE center.

Some of these areas, especially biomaterials and nanomaterials, are covered to some extent by MRSEC projects, but few of their materials are necessarily relevant to the technician level. MatEd plans to cultivate partnerships with these and other relevant ATE projects for the development of core competency needs and modules in these areas.