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AUTHOR Lee, Lung-Sheng; And Others
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ABSTRACT

In Taiwan, technology education used to be called "industrial arts," but was changed to "living technology" in 1997. The goals of craftwork in elementary school are to provide an understanding in the areas of presentation, appreciation, and practical application of the arts. Curriculum content is divided into the three areas. Instruction is principally through hands-on experience, audiovisual materials, and field trips. The goal in junior high school is to provide knowledge and skills in the areas of tools, materials, and production process. The curriculum is divided into 13 areas based on materials and process, each area covering relevant knowledge and skills. Instructional methods include hands-on activity, learning-by-doing, and projects. The aim of industrial arts in senior high school is to provide knowledge of industrial technology, develop industrial skills, stimulate interest in design and creation, and develop good working habits and attitudes. The curriculum uses the integrative concept of industrial cluster. Instruction includes laboratory practice, audiovisual media, and field trips. Craftwork and industrial technology education departments of teachers' colleges and normal universities supply teachers. Problems and obstacles are heavy teacher workloads and poor teaching environment. Future aims are infusing technology education into elementary schools and emphasizing interdisciplinary and experience-based curriculum design. (YLB)

中華民國科技教育簡介

An Introduction to Technology Education in the Republic of China on Taiwan

李隆盛 Lung-Sheng Lee

王應文 Ying-Wen Wang

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蔡尚峰 Sang-Fang Tsai

彭映江 Ying-Chiang Peng

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中華民國科技教育簡介

本手冊介紹中華民國國小、國中、及高中階段的科技教育沿革、現況與展望。

壹、沿革

中華民國目前的國中與高中的科技教育稱爲工藝，但將分別自1997年與1998年改名爲「生活科技」。

小學階段的「美勞」課性質較接近「工藝」。在1975年之前，以勞動教育爲主，1975年以後，美術教育內容漸加重；1996年開始的新課程標準，則以藝術教育爲主，與科技教育漸行漸遠。

國中階段工藝課程是由早期的手工、勞作、生產勞動演變而成現今的工藝。其內涵由早期的木工、金工、籐竹工等，逐漸擴大到包含電工、圖文傳播、營建、製造、資訊工業、能源與動力等。

高中階段在1940年之後，才有勞作課程的設置。後來名稱改爲勞動生產，乃至於工藝。其內涵由製圖、木工、金工、和電工等，轉變爲作業設計與製圖、工業材料、能源工業、資訊工業及自動化等。

以下就課程爲重點，介紹中華民國小學美勞及國、高中的工藝現況。

An Introduction to Technology Education in the Republic of China on Taiwan

The purpose of this booklet is to introduce the background, current situation, and future outlook of technology education in the Republic of China on Taiwan.

I. Background

In Taiwan, technology education is called "industrial arts", a name that will be changed to "living technology" in the school year of 1997.

At the elementary-school level, craftwork is similar to industrial arts, with an emphasis on work education before 1975. Since then, craftwork as a subject has concentrated on fine arts and has gradually become different from industrial arts.

At the junior-high-school level, "handicrafts," "work" and "production work" were the predecessors of industrial arts. Initially, industrial arts included woodworking, metalworking and vine-and-bamboo-working, and gradually expanded to include electricity, graphic communication, construction, manufacturing, information, energy and power, etc.

In senior high schools, it was only after 1940 that "work" which was later to become known as "industrial arts", was included in the curriculum. Initially, it consisted of drafting, woodworking, metalworking and electricity, and gradually expanded to include project design and drafting,

貳、現況

一、小學

(一)課程目標

小學科技教育應重在科技認知，目前關係較爲密切的科目是美勞科。美勞科的內容包括「表現領域」、「審美領域」和「生活實踐領域」。其中「生活實踐領域」以擴展應用藝術、結合生活科技知能、涵養美的情操、以及提昇生活品質爲主旨。

(二)課程架構

在美勞課程中，每一年級都有階段性目標做爲課程內容選取的方向。在內容上有前述三大領域。其中「生活實踐領域」是讓學生在生活與美勞中尋找聯結，並將美勞課所習得的知識、技能應用於生活之中。

(三)實施與評鑑

1.授課時數：

一、二年級每週授課二節，三至六年級每週授課三節。

2.教學原則：

美勞課主要是透過動手做的教學活動，並配合視聽教學與教學參觀進行。

industrial materials, energy, information and automation.

The following is a brief introduction to the current curriculum of technology education in Taiwan, from the elementary to the senior-high-school level.

II. Current Status

(I) Elementary School

(1) Goals

The goals of craftwork are to provide an understanding in the areas of presentation, appreciation and practical application of the arts, and also to provide an appreciation of the technology designed to upgrade the quality of life.

(2) Curriculum Structure

The contents of the curriculum are based on the fixed objective of each year and are divided into three areas-- presentation, appreciation of the arts and practical application. Practical application covers the knowledge and skills of craftwork and tries to relate it to the students' own lives.

(3) Implementation and Evaluation

1. Teaching Hour

The course is 2 teaching hours per week for 1st and 2nd grades, and 3 for 3rd -6th grades.

2. Methods of Instruction

Principally through hands-on experience, audio-visual materials, and field-trips.

3. Instructional Strategies

The aim is to provide a comprehensive and systematic program of activities ranging from basic introductions to in-depth analysis. The program

3.教學重點：

用統整性的概念與系統化的訊息，安排由淺至深的系列活動。過程中明確的告訴學生製作的目的和條件，讓學生瞭解所需的技術與製作的程序。老師也與學生共同討論製作的計畫並預測完成的作品，使學生在有系統的引導之下，學習各項技術與知能。

4.教學評量：

評量標準可分爲「表現能力」、「審美能力」、「生活實踐」三部份。評量兼顧過程與結果以及團隊表現。並配合老師平時對學生各種學習表現與學習態度的觀察，作爲評量的依據。

二、國中

(一)課程目標

現行國中工藝課程於1984年正式實施，主要目標在於教導學生工具、材料和加工程序等知識、技能，使學生瞭解工業社會生活及正確之工作觀念，並提供職業試探的機會。

(二)課程架構

依材料和程序分成十三個領域，各領域都有知識和操作兩部份，其課程架構如下：

should enable students to acquire a clear understanding of the entire technical and making process, from the planning stage through to the finished product.

4. Evaluation

The emphasis is on process, results, and teamwork. Teachers should also take into account the students' attitude and performance.

圖一　國小美勞教學活動

Fig.1 Craftwork instruction in an elementary school

(II) Junior High School

(1) Goals

The current curriculum was developed in 1984, with the objective of providing knowledge and skills in the areas of tools, materials, and production process. Hopefully, an insight into life in an industrial environment and society can be provided along with career exploration opportunities.

(2) Curriculum Structure

The curriculum is divided into 13 areas based on materials and process. Each area covers knowledge and skills relevant to the particular material or process.

表一　國中工藝課程架構

一上	二上	三上
工藝概說 識圖與計畫 木工(一)	木工(二) 金工(二) 圖文傳播	製造工業 資訊工業
一下	二下	三下
陶瓷工 塑膠工 金工(一)	電工 營建與生活	視聽傳播 能源與動力

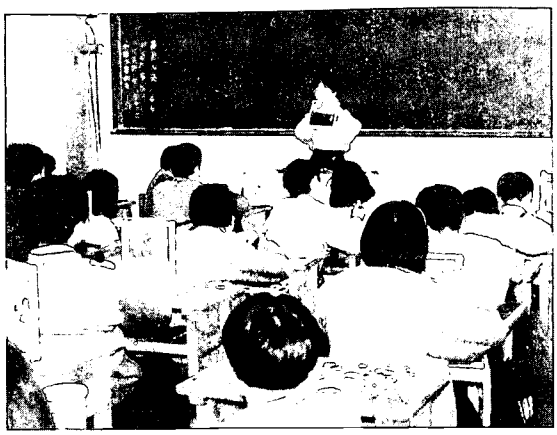
(三)實施與評鑑

1.授課時數：

每週二小時，應連續排課。

2.教學原則：

教學活動以「做中學」爲主要原則，作業依其教學單元性質的不同，進行製作、實驗、裝修、調整等活動。



圖二　國中工藝教學活動(I)

Fig.2 Industrial arts instruction in a junior high school(I)

1. First School Year

a. First Semester

Introduction to industrial arts

Drafting and Planning

Woodworking (I)

b. Second Semester

Ceramics

Plastics

Metalworking (I)

2. Second School Year

a. First Semester

Woodworking(II)

Metalworking(II)

Graphic communication

b. Second Semester

Electricity

Construction and Life

3. Third School Year

a. First Semester

Manufacturing industry

Information industry

b. Second Semester

Audio-visual communication

Energy and Power

(3) Implementation and Evaluation

1. Teaching Hour

The teaching hours are 2 consecutive periods per week.

2. Methods of Instruction

Methods include hands-on activity, learning-by-doing, and projects which should cover a variety of aspects of fabrication, experimentation, maintenance

3.教學要點：

配合教學媒體及適當的教學策略，傳授學生知識及技能，並鼓勵學生自行計畫，以提昇學生之創造能力。此外，亦重視工作安全及良好工作習慣之培養。

4.教學評量：

評量兼顧過程與結果，並以紙筆測驗和實際操作，來評量學生的程度。

三、高中

(一)課程目標

現行高中工藝課程於1984年正式實施，其課程目標在於介紹工業科技知識，培養工業技能，激發設計與創作之興趣，以及培養良好的工作習慣與態度。

(二)課程架構

以工業群集的整體概念，探究現代工業文明。

1.第一學年：

a.作業設計與製圖

b.工業材料

c.能源工業

2.第二學年：

a.資訊工業

b.自動化

and tune-up.

3. Instructional Strategies

The emphasis is on the use of instructional media and strategies to impart knowledge and skills, encouragement of individual planning to improve creativity, as well as safety and good working habits.

4. Evaluation

Both process and results are evaluated by means of written tests and practical assignments.

圖三　國中工藝教學活動(II)

Fig.3 Industrial arts instruction in a junior high school (II)

(III) Senior High School

(1)Goals

The present industrial arts curriculum in senior high schools was formally implemented in 1984. The aim of the subject are mainly to provide knowledge of industrial technology and to develop industrial skills, to stimulate interest in design and creation, and to develop good working habits and attitudes.

(2) Curriculum Structure

The curriculum structure of industrial arts employs the integrative concept of industrial cluster in inquiring modern industrial civilization.

各校可依設備的不同，與當地特色，或視學生程度、需要的不同而調整教材。

(三)實施與評鑑

1.授課時數：

第一、二學年，每週二小時，並連續排課。

2.教學原則：

知識與工場實習並重，並配合視聽媒體與參觀教學等活動進行教學。

3.教學重點：

以實驗、操作和知識傳授爲主，且配合數學、物理、化學等科目，使學生能整合各科的知識。作業須適合學生能力，激發學生興趣，並盡量鼓勵學生自行設計，且應安排合作性質的小組作業。而與課程有關的家庭器具損壞時，可鼓勵學生帶到學校共同研究檢修。此外，並養成學生注重工場安全、愛護工場設備、保持工場清潔的良好習慣。

4.教學評量：

除了實習成品與工作速度之外，學習過程中有關計畫、工作態度，和創造能力都是評量的依據。

1. First School Year

a. Project Planning and Drafting

b. Industrial materials

c. Energy industries

2. Second School Year

a. Information industry

b. Automation

The contents can be adjusted according to each individual school's facilities, local characteristics, and students' abilities and needs.

(3) Implementation and Evaluation

1. Teaching Hour

Industrial arts class is taught for two class hours every week in the first and second school years. These classes should be arranged consecutively.

2. Methods of Instruction

Knowledge and lab practice should both be emphasized with the assistance of activities such as use of audio-visual media and field-trips.

3. Instructional Strategies

Instruction should focus on experiments, manipulation and provision of knowledge, and help students to integrate knowledge from various domains such as mathematics, physics, chemistry, etc. Projects should suit to students' abilities and stimulate their interests. Instructors should encourage students to try their best and to design things independently. Additionally, instructors should arrange group projects on a cooperative basis. Instructor should also encourage students to bring unworkable household utensils to schools and repair them together. Furthermore, the development of good habits such as site safety, maintaining equipment in good condition and site cleanliness should be

圖四　高中工藝教學活動

Fig.4 Industrial arts instruction in a senior high school

四、師資培育

小學美勞課的師資，由師範院校的美勞教育系或組培育；國中與高中科技教師培育主力，則是臺灣師範大學與高雄師範大學的工業科技教育學系。在師資培育法通過之後，雖然師資來源多元化，但由於生活科技教師需要較專門的知識與技能，因此未來師範院校的美勞教育系與工業科技教育系仍爲最主要的師資培訓單位。目前，兩所師大的工技教育系設有碩士班，除了提供教師進修的管道外，也推廣科技教育理念、進行研究發展與學術交流。

emphasized.

4. Evaluation

Besides project quality, and speed of work, planning, working attitudes and creativity should all be considered during evaluation.

III. Teacher Education

Craftwork teachers in elementary schools are almost all graduates of the craftwork education departments/ programs of teachers' colleges. Technology education teachers in junior and senior high schools are mainly from the Department of Industrial Technology Education of National Taiwan Normal University or National Kaohsiung Normal University. After the Teacher Preparation Law was passed, the backgrounds of teachers have become more diverse. However, since living technology demand the possession of specialized knowledge and skills, the craftwork education department and the industrial technology education department of the teacher's colleges and normal universities continue to be the major institutions for supplying qualified teachers.

Currently, the Department of Industrial Technology Education of both the normal universities offer masters' programs, which provide the opportunities for inservice teachers' advanced studies and also work on information exchange, research and development for promoting the quality of technology education.

IV. Instructional Resources

Textbooks are edited by private publishers and reviewed by the National Institute for Compilation and Translation, and selected by school teachers. The

圖五 臺灣師範大學工業科技教育學系

Fig.5 National Taiwan Normal University Department of Industrial Technology Education

五、教學資源

教科書由民間出版社編輯，由國立編譯館審查後由學校選採。教學活動所需的材料大都由老師負責向民間廠商購買，由學生自行負擔費用。此外，台灣省政府教育廳每月出版「中學工藝教育月刊」，免費提供在職教師參考。中華民國工藝教育學會亦透過年會、研討會等活動，提供學術交流的機會。

六、問題與困境

(一)學科名稱造成誤解

一般人從字面上以爲「工藝」就是傳統「手工藝」，因而誤解了工藝的內涵。

(二)教師負擔沉重，士氣低落

工藝科不是升學考試科目，所以常被視爲副科，無法受到學校、家長、及學生的重視。而且工藝教師在學生人數眾多及

materials required for teaching activities are mostly decided by teachers and are purchased from manufacturers, and the students pay these charges themselves. Additionally, Taiwan Provincial Education Department publishes the "Secondary-school Industrial Arts Monthly" to provide teachers with the latest information in the field of technology education, and conferences organized by the "Chinese Industrial Arts Education Association" provides opportunities for information exchange.

V. Problems and Obstacles

(1) Misunderstandings arising from the naming of subjects.

Many people consider the term "industrial arts" to refer to traditional "handicrafts", and therefore misunderstand the essence of industrial arts.

(2) Heavy workload of teachers

Industrial arts education is not included on entrance examinations for further study, and therefore is usually considered a "lesser" subject and not highly regarded by school administrators, parents and students alike. Furthermore, class sizes are large and teaching resources inadequate. In fact, teaching hours are longer than for other subjects. This puts a heavy burden on industrial arts teachers, and under these conditions morale among industrial arts teachers is generally low.

(3) Poor teaching environment

The teaching environment for industrial arts in many schools is of an inferior standard. For instance, space is limited, the number of labs is inadequate, equipment is out-of-date, and so on.

教學資源欠缺下，每周授課時數又多於一般升學科目，造成工藝科教師負荷重，普遍士氣低落。

(三)教學環境不佳

許多學校的工藝教學環境未達標準，例如：工場空間狹小、數量不足、設備老舊.....等。

參、展望

未來生活科技課程主要在培養全民所需的科技素養。而各階段之科技教育目標爲：國小重在科技覺知，國中重科技試探，高中階段重科技定向與準備。努力方向如下：

1. 落實小學美勞教育中科技教育的基礎。
2. 重視科際整合及經驗本位的課程設計。
3. 確認科技素養指標，發展學校本位的課程。
4. 加強國內外科技教育理念與實務的交流。

圖六、工藝競賽活動

fig.6 An industrial arts competition

VI. Outlook

In the future, "living technology" will be aimed at enhancing the technological literacy among the general population. The goals of technology education at each stage are: technological awareness in elementary schools, exploration of technology in junior high schools, and technological orientation and preparation in senior high schools. The following are the future aims of technology education:

1. Infusing technology. education into elementary-school level craftwork.
2. Emphasizing interdisciplinary and experience-based curriculum design.
3. Developing the school-based program in accordance with technological literacy standards.
4. Increasing exchanges, both at home and overseas, regarding the theoretical and practical aspects of technological education.

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Printed Name/Position/Title:
Lung-Sheng Lee, Professor; Ying-Wen Wang, Research Associate; Ning-Chun Chen, Fang-Rung Lin, Sang-Fang Tsai, & Ying-Chiang Peng, Graduate Students

Organization/Address:
Department of Industrial Technology Education
National Taiwan Normal University
162 Hoping E Rd, Sec 1
Taipei 106, Taiwan, R.O.C.

Telephone: +886-2-321-3664
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