



Iowa Research Online

The University of Iowa's Institutional Repository

[Honors Theses at the University of Iowa](#)

Spring 2021

The Engineering, Science, and Management War Training Program: Higher Education and the Second World War

Dieter Ostermann

Follow this and additional works at: https://ir.uiowa.edu/honors_theses



Part of the [United States History Commons](#)

This honors thesis is available at Iowa Research Online: https://ir.uiowa.edu/honors_theses/364

THE ENGINEERING, SCIENCE, AND MANAGEMENT WAR TRAINING PROGRAM: HIGHER
EDUCATION AND THE SECOND WORLD WAR

by

Dieter Ostermann

A thesis submitted in partial fulfillment of the requirements
for graduation with Honors in the History

Colin Gordon
Thesis Mentor

Spring 2021

All requirements for graduation with Honors in the
History have been completed.

Alyssa Park
History Honors Advisor

The Engineering, Science, and Management War

Training Program:

Higher Education and the Second World War

Dieter Ostermann

Honors Thesis in History

Fall 2020

Advisor: Colin Gordon

Abstract

In 1940 the United States faced the looming threat of another global conflict while still recovering from a debilitating economic depression. The American government acted quickly and established numerous federal programs designed to meet foreseeable needs of the nation across a wide spectrum of categories. One such program established in 1940 was the Engineering, Science, and Management War Training Program designed to rapidly produce scientific and technical specialists for crucial defense industries. A distinct attribute of the program was the diversity of its participants due to the prohibition of discrimination on the basis of race, sex, or age. This allowed for traditionally excluded groups such as women and people of color to participate in industries and educational fields in which they were historically not prevalent. This thesis explains both the impact of the program on its participants and the general war effort as well as federal involvement in education and training during the wartime years. This analysis is achieved through evaluation of official government publications, historical newspaper articles, past dissertations written on related subjects, and more recently published books providing supplemental information. Ultimately, this work aims to contribute to a more comprehensive account of the ESMWT program's impact on its participants, the general war effort across the home front, and federal involvement within higher education.

The Second World War was a time of upheaval politically, socially, and culturally for many nations across the world and the United States was no exception. The American economy had only recently begun to climb out of the shadow of the Great Depression and the looming possibility of involvement in WWII required the mobilization of not only the people and manufacturing, but also of higher education. Massive industrial production and technological superiority would be necessary for the United States to both compete and win against the Axis powers. The number of highly educated and trained technical personnel who could be mobilized for these efforts was vastly insufficient. As a result, plans were created for a program designed to streamline the training of these required personnel utilizing the already existing universities and colleges across the nation.

The Engineering, Science, and Management War Training (ESMWT) program was a government sponsored program during the years 1940-1945 which provided college-level classes to Americans in order to train them quickly to fill vital engineering and managerial positions in civilian defense industries. The ESMWT program offered these classes at universities and colleges across the nation to all Americans regardless of their sex, race, or color. It is clear the valuable training conducted within these classes not only made a meaningful contribution to the war effort, but also offered opportunities to those who had been traditionally excluded. Given how successful the program was, including the cooperation within the program between the federal government and institutions of higher education it is unsurprising that substantial benefits for education and training were later included in the G.I. Bill.

The “War to End All Wars” at the beginning of the 20th century saw the invention and use of killing machines that had once only been possible in the theoretical. Aircraft,

rapid-firing machine guns, chemical weaponry, tanks, and numerous other advancements experienced their first wide-spread and effective use during the war and left a lasting impression on its participants and spectators alike. The First World War had shown the world that the future of warfare would be one of mechanization and destruction on a massive scale. When the flames of war once again began to spread across the globe in the 1930s, the American government knew that if those conflicts escalated, the nation would eventually be involved in some manner and they must be prepared for this eventuality. Still recovering from the debilitating effects of the Great Depression, the government was aware that labor and resources had to be used effectively in order to fight a war abroad as well as maintain what stability had been created on the home front. To facilitate this endeavor numerous government programs were created to plan for the wartime demands for everything from bullets and beans to childcare and airplanes. For the nation to be prepared for war the United States military would require a two-ocean navy, fifty thousand airplanes, and a million and half men strong mechanized army.¹²

In order to meet these demands, the country would first need to possess the necessary shipyards, plants, as well as the required engineers to create and operate within these facilities. While shipyards and plants already existed, or could be built quickly, and additional civilian factories could be repurposed for military use, the number of engineers required to run the operations was not something that could be supplied immediately. A deficit of engineers already existed in civilian industries and the number of students

¹ Herluf V. Olsen, National Defense and the Collegiate Schools of Business. In *American Association of Collegiate Schools of Business Proceedings of the 23rd Annual Meeting* (University of Minnesota, 1941), 69.

² U.S. Department of State, Publication 1983, *Peace and War: United States Foreign Policy, 1931-1941* (Washington, D.C.: U.S., Government Printing Office, 1943), 525-31.

graduating from engineering universities would not nearly be enough to meet the requirements for military demand on top of that.³ For example a study conducted pre-war found that “in the Pittsburgh area there were only 257 engineers qualified for the kinds of production engineering envisioned, a tenth of the anticipated need”.⁴ As a result, planning began for a program which would facilitate the training of engineers and other specialists who would be essential for manufacturing and other wartime tasks. It was decided that this program would be sponsored by the U.S. Office of Education due to the level of training required and on October 9th, 1940 was established as the Engineering Defense Training (EDT) program, though commonly referred to as the ESMWT program.⁵

Background

The First World War

The development and recognition of the need for training like the Engineer, Science, and Management War Training (ESMWT) program was directly based on lessons learned and seeds planted from America’s involvement in the First World War. Prior to President Wilson’s request to congress for a declaration of war, the Office of Education and other Federal agencies had continued working the previous two years as though business was usual.⁶ Although, for the Office of Education, this was primarily due to lack of resources rather than the belief that America would not be involved in the war. As a result no

³ U.S. Office of Education, and Henry H Armsby, *Engineering Science and Management War Training Final Report*. (Washington, DC: U.S. Government Printing Office, 1946), 7.

⁴ Virgus R. Cardozier, *Colleges And Universities In World War II*. (Westport, Conn.: Praeger, 1993), 185.

⁵ Ibid, 11.

⁶ Richard Wayne Lykes, *Higher Education And the United States Office of Education (1867-1953)*. (Washington: Bureau of Postsecondary Education, United States Office of Education, 1975), 65.

planning for any training programs had been created prior to U.S. involvement and there was “consequently little time to prepare”.⁷ During the war, the Office of Education mainly concerned itself with publication of propaganda, evaluation of the war’s effects on American schools, and fostering good-will with foreign nations through educational material swaps.⁸ However, Dr. Hollis Godfrey, the Commissioner for Engineering and Education and member of the Advisory Committee under the Council of National Defense, did publish a statement in 1917 detailing some of his objectives.

With the entrance of the United States into the war it became desirable to establish a common policy of cooperation between the higher institutions and the Government ,a policy which would result in the fullest utilization of higher educational resources of the country for national defense and service.⁹

This appears to be the first formulation of the idea of a cooperative engineering training program between the federal government and facilities of higher education. Godfrey’s committee members were chosen from representatives of these facilities and all were extremely willing and enthusiastic to work on such a program. However, nothing ever came to fruition from this committee or the plans laid because though there was a recognized need for technical training of men by the War Department, the program which was discussed simply never existed.¹⁰ Historian Richard Lykes states that the failure for any implementation of this theoretical program came down to two main factors. His first point was that the length of the war was simply too short for any “comprehensive program to be organized and put into operation”.¹¹ The lack of any real preparation by the Office of

⁷ Ibid

⁸ Ibid, 66.

⁹ Lykes, *Higher Education And the United States Office of Education (1867-1953)*, 67.

¹⁰ Ibid, 73.

¹¹ Ibid, 78.

Education meant there were no plans or resources that could be utilized for an engineering training program of any significant size. The second factor was the failure of both the government and universities to see the value and need of a program for “controlled production of skilled and educated manpower”.¹² Lykes attributes this to a combination of the freshness of the total war concept, the general reluctance of federal officials to interfere with facilities of higher education, and “the deep-rooted tradition of academic freedom”.¹³ Even with no program ever being truly devised, the war still had massive benefits for the Office of Education and made headway for the future cooperation between federal educational leaders and colleges and universities. The most important conclusion which Lykes arrives at was that “the war showed that higher education was vital to national defense”.¹⁴

During WWI engineering colleges had been utilized by the United States Army for vocational training, yet this training was primarily concerned with mechanics and little training was actually done on an engineering level.¹⁵ As Figure 1 displays, the training for “engineers” during WW1 was not concerned with supervisory, research, or fine technical positions which engineers from higher educational facilities could fill. This was regarded as poor utilization of the schools by professional

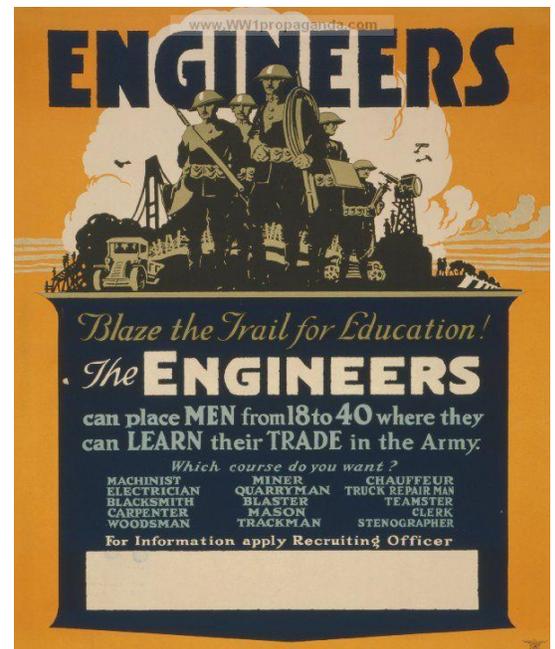


Fig. 1
An example of the various occupations for which some training was conducted during WW1

¹² Ibid

¹³ Lykes, *Higher Education And the United States Office of Education (1867-1953)*, 79.

¹⁴ Ibid

¹⁵ U.S. Office of Education and Henry H Armsby, *Engineering Science and Management War Training Final Report*, 8.

engineers and it wasted valuable instruction opportunities for training engineers. Although the modernization and mechanization effort of armies increased during WW1, the war was finished before engineers were really needed on a significant scale for production or research requirements. However, the technological and tactical failures of certain strategies and armies during WW1 proved that warfare must adapt, and large numbers of scientists and engineers would be essential for constant improvement of weapon and industrial technologies. As Henry Armsby, special advisor to the ESMWT program, observed, "In the first world war machines were introduced to aid the efforts of the armed forces. In modern warfare it can be said without exaggeration that without machines organized military effort is completely ineffective against a mechanized enemy".¹⁶ The scale of the global conflict also necessitated an evaluation of production facilities for standard goods, weaponry, and machines in order to guarantee that the necessary output could be provided and maintained consistently. The federal government had made multiple mistakes during WW1 when it came to utilizing higher education facilities and educated persons. The first major mistake was waiting too long to begin defense training programs and the second was the drafting of educated persons for military service when they could be better utilized in the occupation they were trained for.

In the years between the First and Second World War there was a large increase in the number of vocational and trade schools with over a thousand public ones in existence by 1940. The hope was that these schools would be used for their relevant training in mechanics and other basics, leaving the more advanced engineering schools free to continue the training provided at their level. The New Deal era programs had changed the

¹⁶ Ibid

United States and by 1940 the United States' government "was much bigger and more powerful than it had been in 1932".¹⁷ The Office of Education itself had not undergone significant change or had any real developments until 1934 when the National Youth Administration (NYA) was established under the Works Progress Administration (WPA). Though this program did have the Office working with facilities of higher education, there is nothing of significance when it came to engineering that occurred until 1940 when planning began for an engineering training program. Unlike WW1, federal leaders made extensive preparations prior to official American involvement in WW2 and early economic mobilization began in the late 1930s.

Mobilization

Public-Private Mobilization

Mobilization for the Second World War was dictated by the government and by the private sector. Corporate America had to be mobilized for the war alongside the military, for this was a conflict which necessitated complete commitment. Early on there were disagreements about how the recovering economy and manufacturing power of the United States should be utilized. Some remembered the large profits corporations were able to reap in WW1 and hoped that tighter government control would curtail big business' gains.¹⁸ On the other side there were those who believed that private industry should produce war material and the majority of the production with the government footing the bill and "otherwise staying out of the way".¹⁹ The end result was something of a mixture

¹⁷ John W Jeffries, *Wartime America: The World War II Home Front*. (Chicago: Ivan R. Dee, 1996), 17

¹⁸ Wilson, *Destructive Creation : American Business and the Winning of World War II*, 44

¹⁹ Ibid, 44

between the two views with contracts and production orders handed out to businesses by federal officers, but the U.S. government still supervised and guided the overall industrial mobilization. GOCO (Government Owned, Contractor Operated) facilities are one of the finest examples of this public-private synergism.²⁰

While pre-war industrial mobilization had largely involved midsize contractors, the increasing usage of the GOCO plants in the early 1940s saw some of the nation's largest industrial corporations building and operating these facilities.²¹ The GOCO facilities were almost entirely funded through public dollars and leased out to contractors to operate and use for production of war material, often being sold to the same companies post-war for small amounts relative to their cost.²² The contracting companies dealt with only small operating costs and did not have to put forward capital for a new facility which was an enticing enough prospect for many companies to happily assist production efforts in the defense industries. This compromise led to a huge output of industrial production and although the government "rose slowly and imperfectly" to the challenges presented by mobilization they were "ultimately successfully".²³ The ESMWT program was constructed on a similar idea where the government would pay for the operating costs created by the classes, but the classes were provided and taught by the educational facilities' staff. The institution also received similar benefits post-war as the GOCO facilities, as I will discuss further later.

Appeals for Patriotism and Sacrifice

²⁰ Ibid, 56

²¹ Ibid, 55

²² Ibid, 208

²³ Jeffries, *Wartime America: The World War II Home Front*, 18

World War II required economic, industrial, and labor mobilization on a nation-wide scale. Only three months into the nation's entry into war, it became evident that victory would require the involvement of every person and "total commitment" to the war effort.²⁴ American propaganda focused on "patriotism" in order to create support for the war and maintain morale on the home-front. Some propagandists attempted to sell the war through the citizen's obligation to the state's defense or by showing the threats that opposing nations could pose to Americans if they should win and then inevitably force their rival ideology upon them.²⁵ The individualism of man, and especially Americans, meant that the war had to be sold in a fashion which brought it home to the viewer. Norman Rockwell's famous "Four Freedoms" is a fine example of one type of this propaganda as it brought to mind the obligation to family and showed what Americans were fighting to preserve. While normally the state should operate for its citizens' protection, WWII made necessary for citizens to work for the state's protection.

The conditions of the war made it necessary for Americans from all walks of life to sacrifice certain standards or luxuries. The demands of the wartime economy necessitated the curtailing of production of civilian goods and rationing was implemented to control resources vital to war industries. Civilians were further encouraged to participate in the war effort through things like Victory Gardens, bond drives, and scrap collection. Freedom and Patriotism were keywords in selling the war as no person wanted to appear "Un-

²⁴ Lewis A Erenberg and Susan E Hirsch. *The War in American Culture: Society and Consciousness during World War II*. (Chicago and London: University of Chicago Press, 1996), 24.

²⁵Robert B. Westbrook, *Why We Fought: Forging American Obligations in World War II*. (Washington, DC: Smithsonian Books, 2004), 40.

American” through their own perceived selfishness. Images such as those appearing in Figure 2 were widespread across the home front as propagandists put their best effort towards selling the war and enticing sacrifice. This “sacrifice” also included the need for large-scale recruitment of women for labor positions and wartime programs due to the holes in manpower left by the implementation of the Selective Training and Service Act of 1940.

The Engineering, Science, and War Management Training Program

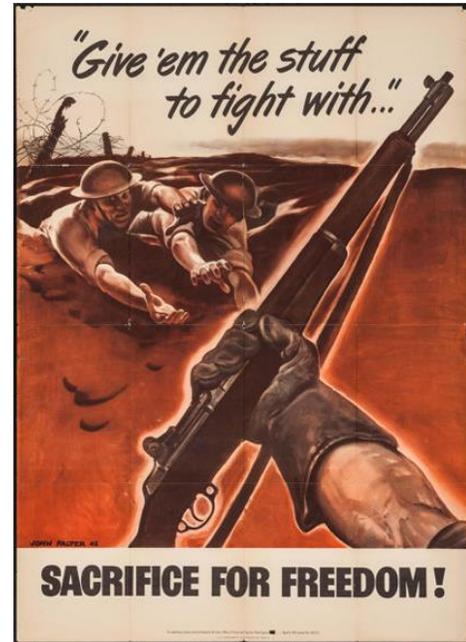


Fig. 2

The defeat of multiple Allied nations in the early years of the war due to the success of the modernized German military made it clear that the war would not be short and victory would require all of America’s industrial and technological power. Henry Armsby was the Specialist in Engineering Education for the Office of Education for most of the wartime years and in the ESMWT program’s final report, he stated that even by 1940 “warfare had become a test of the relative total scientific, engineering, and manufacturing skills and capacities of the belligerent nations.”²⁶ The nation was mobilizing both in warfare and industry as the United States created industrial expansion plans for dockyards, factories and other facilities.

Early on in this planning they realized their “most critical bottleneck in the national defense effort” was the lack of engineers and technicians required for the “planning,

²⁶ U.S. Office of Education and Henry H Armsby, *Engineering Science and Management War Training, Final Report*, 8

production, operation, management, and research” of the entire defense effort.²⁷ With this need identified and the deficit too great to overcome even with accelerated graduation of engineering students in university, the Office of Education set to devising a program which could produce technicians and fill the needed engineer roles quickly. The vocational schools developed in the Interwar period were believed able to provide training for trade-school and secondary school level, but the fields in this program requiring advanced instruction for engineering would require the usage of existing engineering colleges and their infrastructure.²⁸ Taking note of lessons learned from previous experience in WW1, the plans were laid for the actual program itself in late 1940 under the working name of the Engineer Defense Training (EDT) program as engineer training is all it was initially concerned with. The goals of the program changed as the nation’s needs did, but when first developed the primary goal was simply for a program which provided “courses designed to meet the shortage of engineers with specialized training in fields essential to the national defense”.²⁹ The success of the program in initially meeting this goal and the arising need for training in similar fields saw two more categories added as the war progressed, science and management. The title was changed to include these and the word Defense was also changed to War in 1943 making the final title The Engineering, Science, and Management War Training (ESMWT) program which is what the program is almost always referred to as for all years. The ultimate objective of the program throughout its life was very simple, “to

²⁷ Ibid

²⁸ Ibid,9

²⁹ Ibid,15

conduct training to meet the shortage of engineers, chemists, physicists, and production supervisors in fields essential to the national defense”.³⁰

Mobilization of Education

In World War I college and university officials were enthusiastic about assisting in the war effort and were very willing to work with the federal government. However, as discussed previously the federal government had not planned well enough to properly utilize the higher education facilities or have the time to enact a working program.³¹ In WW2, universities and colleges decided to be ready even before they were called upon. As the federal government laid plans for defense training programs, individual institutions were establishing their own defense committees. These defense committees were established to perform certain functions which included the “cataloging of ways in which each campus could contribute to the defense effort” and setting “priorities for each institution in serving each need”.³² These defense committees made the implementation and beginning of the ESMWT program occur much quicker when compared to similar program planning in WW1 and no doubt made federal cooperation with higher education much easier. These committees were widespread as well with an estimated 200 institutions having a defense committee in Fall 1940 which no doubt helped facilitate the implementation of the ESMWT program on a nationwide scale.³³

Autonomy of Education

³⁰ U.S. Office of Education and Henry H Armsby, *Engineering Science and Management War Training, Final Report*, 75

³¹ Lykes, *Higher Education And the United States Office of Education (1867-1953)*, 70

³² Cardozier, *Colleges And Universities In World War II*, 26

³³ Ibid

One of the founding policies and beliefs of the ESMWT program was that it would be a program of the institutions assisted by the Office of Education, not a program of the Office of Education assisted by the institutions.³⁴ This was partially due to the fact that college officials remained “bitter about the fact that when the military services did call on higher education in World War I, they virtually took control of campuses.”³⁵ It is also because many of the staff members in the beginning and further on were almost always deans, professors, or professional engineers themselves and were not looking to remove institutional autonomy. It was hoped that this strategy of minimizing federal control would lead to the greatest possible output as each school would develop the program in the manner which best fit them. In accordance with this general strategy of respecting the autonomy of the institutions, the decision was made to not overrule the school’s existing policies and the rights granted to them by their respective charters. This level of autonomy was also necessary due to the size and scope of the program which the small staff in the Division of Higher Education would not have been able to handle.

Organization

The original plan for the program called for 14,000,000 dollars which “would make it possible to provide for the training in engineering colleges of about 58,000 people for an average training period of approximately 3 months each.”³⁶ The founders of the program believed that initial funding would be granted and as such planned their organization on a larger scale than this number represents. The program was broken down into groups of

³⁴ U.S. Office of Education and Henry H Armsby, *Engineering Science and Management War Training, Final Report, IX*

³⁵ Cardozier, *Colleges And Universities In World War II*, 20

³⁶ U.S. Office of Education and Henry H Armsby, *Engineering Science and Management War Training, Final Report*, 12

staff, one field staff and one central staff. The central staff was in Washington and focused on administrative tasks on a national level such as working with other government agencies, publishing program material, and preparing course guidelines.³⁷ The field staff worked with the colleges and universities to evaluate the needs of the local industries and “supervised the training programs in the field”.³⁸ In order to run the program on a nationwide level the country was divided in 22 regional areas with each region having an appointed advisor. This advisor was then responsible for forming their own regional committee made up of representatives for the institutions in his or her area which would coordinate the program’s training.³⁹ The first regional advisors “were recognized leaders in engineering education” who worked for no compensation and were mostly left to their own devices.⁴⁰ Each region was responsible for contacting the industries in their area and determining the respective training needs, but in order for the class to be approved and funding allocated it was required for them to contact the federal staff through the regional committee.

Two hundred and twenty-seven institutions officially offered classes as part of the program and the total number of trainees was 1,795,716 at a total cost of \$59,967,065 (around \$870 million today).⁴¹ The actual number of institutions was likely much higher as many institutions often subcontracted to other schools which were not approved. Some of the most common usages were the renting of classroom space or borrowing of faculty for

³⁷ Ibid, 14

³⁸ Ibid

³⁹ Ibid

⁴⁰ U.S. Office of Education and Henry H Armsby, *Engineering Science and Management War Training, Final Report*, 16

⁴¹ Ibid, 36

instruction.⁴² Enrollment peaked between 1942-1943 when the number of trainees was around 600,000 taking almost 13,000 classes offered at 214 institutions across the United States.⁴³ Although science and management classes were offered after 1941, the focus of the program remained engineering for the entire duration. 75% of enrollments were for engineering courses, production supervision was second at 21%, and chemistry and physics both around 2%.⁴⁴ General guidelines were published by the Washington staff for common need classes, for example radio engineering, but the classes were different at each institution as specific training procedures were decided by the school.

Training

From the beginning, the program's founders made it clear that they were not attempting to create fully qualified professional engineers, instead they were trying to "give specific, intensive training to meet specific and definitely determined needs of defense and war industries."⁴⁵ To create an engineer from a fresh high school graduate would take as much 7 to 8 years due to the education required, years which the United States did not have. Instead the plan was to take some of the less essential tasks which would normally be done by college graduates and supplement them instead with people supplied with the minimum training needed to fulfill their specific task. In this way occupations such as inspector, laboratory technician, or draftsman could be filled by prepared individuals even if those people had "little or no education in related fields".⁴⁶ The other common form of

⁴² Cardozier, *Colleges And Universities In World War II*, 176

⁴³ U.S. Office of Education and Henry H Armsby, *Engineering Science and Management War Training, Final Report*, 45

⁴⁴ Lykes, *Higher Education And the United States Office of Education (1867-1953)*, 131-132

⁴⁵ U.S. Office of Education and Henry H Armsby, *Engineering Science and Management War Training, Final Report*, 8.

⁴⁶ *Ibid*

training offered was the retraining of one type of engineer to another more in demand field, e.g. a mechanical engineer to an ordinance inspector. Having minimally trained personnel take up the lesser tasks would free the better educated engineers for this retraining process or allow them to focus on the positions most vital to the defense industries. The number of personnel being trained and funding given to the institutions made an immediate impact to their respective campuses as they had been dealing with decreasing enrollment since even before U.S. entry into the war.

Campus Change

As the United States ramped up for war in 1939-1941 there was a decline in male enrollment across higher educational facilities. A large portion of this can actually be attributed to men leaving college for civilian jobs in “manufacturing, in the construction of military camps, and in other sectors of the economy”.⁴⁷ Although the draft was the cause of some men having to leave college or postpone their enrollment, more men left for these civilian jobs than entered the military in Fall 1941.⁴⁸ By 1942, the enrollment of male students was down 20%-70% at various institutions across the nation and the loss of income associated with this enrollment decline no doubt caused universities to be much more open to offering defense training courses. The ESMWT program provided many benefits for the universities and colleges which hosted courses and often by the end of the war these schools had improved in several ways. Similar to GOCO facilities in industrial mobilization, the most concrete benefit of educational mobilization was the ownership for the institutions of equipment bought for the courses. The ESWMT program was intended to

⁴⁷ Cardozier, *Colleges And Universities In World War II*, 112

⁴⁸ Ibid

have no financial loss incurred on the behalf of the participating schools and so any equipment deemed necessary for the courses was paid for by the government. Some institutions did take some monetary loss as they did not always request funding for some ventures, but it is believed that this was partially “for patriotic reasons”.⁴⁹ Universities and colleges were willing to sacrifice space and money for the war effort that the entire nation was devoted to. This did not go without notice and a month after V-E day it was decided that when the program was ended, the equipment purchased should be granted to the institution that used it.⁵⁰ The total amount spent on equipment over the course of the program was \$3,386,793 dollars (almost \$50 million today) which includes both equipment bought and equipment rented.⁵¹ Nevertheless, this was a significant amount for some institutions and represented a real impact for their future student’s education. There was also an increased level of cooperation between institutions with schools sharing their difficulties so others could learn, loaning faculty for instruction, and the sharing of new training techniques.⁵² The institutions were united in their efforts and were not competing for students, but instead competing to win the war. The new training techniques had to be developed because of the new format of classes, the industrial focus, and the demographics of the trainees. 94% of trainees were already working in the industries they were receiving training for and as a result many classes took place in the evening or night which led to many people seeing the “need and value of night school” offered by the colleges.⁵³ Classes

⁴⁹ Ibid, 124

⁵⁰ U.S. Office of Education and Henry H Armsby, *Engineering Science and Management War Training, Final Report*, 15

⁵¹ Ibid, 121

⁵² Ibid, 68

⁵³ Ibid, 65

were also longer, featured more student participation in discussion, and used “problem material directly from industry”.⁵⁴ The direct training for specific tasks also made educators notice that it was not always necessary for certain prerequisites to be completed. For example, students could learn about thermodynamics even with no prior course in calculus and still perform their duties to the standard.⁵⁵ The demographics of the classes also influenced colleges as instructors learned to teach to groups they may not have interacted with on the same scale. The major non-traditional groups in defense training were women and African Americans. Women for the most part trained much the same as men and were well received in both their schooling and industrial positions. African Americans on the other hand suffered from the racial bias inherent in mainstream society and faced numerous difficulties in even just participating in the program.

Non-Traditional Recruits

Just as general industrial labor shortages required the inclusion of women on a hitherto unseen scale, programs like the ESMWT also required concessions to be made on the type of recruits who would be accepted. Notably, this general shortage likely influenced a part of what makes the ESMWT program so extraordinary which was its prohibition of discrimination of any participants based on their race, age, or sex. In the United States, the wartime boom offered women and Africans Americans new opportunities and radical change on a number of fronts. The ESMWT program was quite progressive regarding the makeup of its membership and the Congressional Act which saw

⁵⁴ Ibid, 68

⁵⁵ U.S. Office of Education and Henry H Armsby, *Engineering Science and Management War Training, Final Report*, 68

its creation made it clear who was able to participate. When asked about discrimination within the program there was the same answer in each of the yearly “Answers to Questions” publications about the program put out by the Office of Education:

The Act specifies that “No Trainee *** shall be discriminated against because of sex, race, or color, and, where separate schools are required by law for separate population groups to the extent needed for trainees of each such group equitable provisions shall be made for facilities and training of like color.”⁵⁶

This meant that the program would not only run and fund defense training classes for men, but also for women and other non-traditional students. However, even with this concession it was still up to the individual schools on who they would choose to admit as the publication would explain immediately after that answer. Although many schools opened their doors to previously barred groups, schools still retained autonomy when it came to admission.⁵⁷

Women for the Program

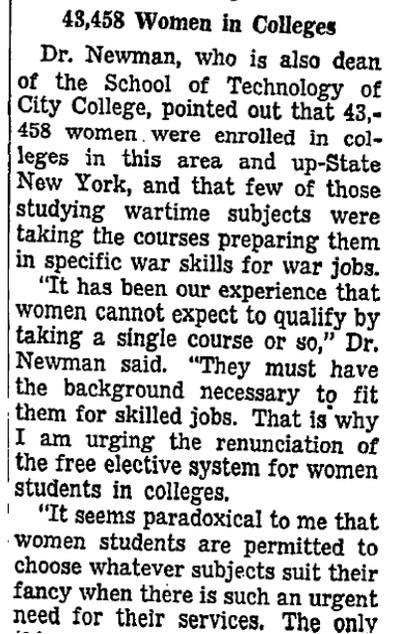
At the time, there was a belief held by some that most women in higher education were only there to find a husband and that they were not truly there for educational purposes. With the United States’ entry into the war and all the nation’s effort being put towards the war, women were sometimes criticized for their choice of study. An example of

⁵⁶ United States, Federal Security Agency, U. S. Office of Education. (1941). “*Answers to Questions Pertaining To Engineering, Science, and Management Defense Training Program*”. Washington.

⁵⁷ U.S. Office of Education and Henry H Armsby, *Engineering Science and Management War Training, Final Report*, 45

this opinion is shown in Figure 3 and, although condescending, it displays the view held by some that women were not applying themselves to the war effort as much as they should be. In addition, "A study by the American Council on Education claimed that of 100,000 female college graduates in 1942, fewer than 30 percent majored in subjects that were directly applicable to war needs."⁵⁸ The ESMWT program therefore was a way in which women could take classes relevant to the war effort, even if they did not have the required background normally needed.

Even more so, official publications put out by the administrators for the program often encouraged the recruitment of women. Like other programs, women were encouraged to participate in the ESMWT program due to their exemption from the Selective Service Act. In fact, one document even stated that "efforts to recruit and train for war industries must necessarily be directed primarily to women and men who are not likely to be inducted."⁵⁹ In the first year of the ESMWT program female enrollment was only 841 out of a total of 120,802 students, however by fiscal year 1942 enrollment had grown to 130,245 leading to a ratio where 1 in 6 trainees were women.⁶⁰ The reason for this increased enrollment can be attributed to two factors. First there was a drop in male availability for ESMWT classes due



43,458 Women in Colleges
Dr. Newman, who is also dean of the School of Technology of City College, pointed out that 43,458 women were enrolled in colleges in this area and up-State New York, and that few of those studying wartime subjects were taking the courses preparing them in specific war skills for war jobs. "It has been our experience that women cannot expect to qualify by taking a single course or so," Dr. Newman said. "They must have the background necessary to fit them for skilled jobs. That is why I am urging the renunciation of the free elective system for women students in colleges. "It seems paradoxical to me that women students are permitted to choose whatever subjects suit their fancy when there is such an urgent need for their services. The only

Fig. 3

⁵⁸ Amy Bix, *Girls Coming to Tech!: A History of American Engineering Education for Women*. (London: MIT Press, 2014.), 58

⁵⁹ United States, Federal Security Agency, U.S. Office of Education. (1944). "Answers to Questions Pertaining To Engineering, Science, and Management War Training Program", 9.

⁶⁰ U.S. Office of Education and Henry H Armsby, *Engineering Science and Management War Training, Final Report*, 45

to the draft and other male only selections limiting the pool of available males. Second, the program expanded after its first year to include administration and management roles that did not require as extensive technical knowledge. Courses which fell into this category, such as “personnel administration, inspection and testing, communications, etc.” had high enrollments of women as they did not require prior knowledge or training in engineering.⁶¹ White women were happily received because most of those who participated in the classes had not been involved with relevant war work prior and few had training in engineering or scientific knowledge. Therefore they were one of the best candidate groups because through training they could be put into positions where they could begin to aid the general war effort and the training provided to them would actually make a measurable impact. Of the women trained as part of the ESMWT program “nearly all of them found employment in war industries at jobs customarily assigned to men.”⁶²

The women in these positions obviously made impacts in the industries they were assigned to through production, management, and other tasks but they also did more. The 282,235 women who filled positions of technical, scientific, and managerial need freed enough men up to constitute almost 19 military divisions; for scale, the Italian Campaign was won using 11 divisions.⁶³ The women who participated in the wide variety of classes offered by the ESMWT program were often well received by both their teachers and employers. Regarding women’s performance in the classes as well as in their appointed jobs, they were usually graded equal to that of their male counterparts and sometimes

⁶¹ Cardozier, *Colleges And Universities In World War II*, 172

⁶² U.S. Office of Education and Henry H Armsby, *Engineering Science and Management War Training, Final Report*, 47

⁶³ Ibid

even greater within certain occupations such as drafting.⁶⁴ Not only did the nation benefit from women's efforts, but the women benefited as well. This example recounts the experience of one woman who explains her success and satisfaction after participating in the program:

From Edmonton a girl who intended to be a teacher but who, after Pearl Harbor, took ESMWT training as a draftsman at the University of California, writes: "I am the only girl in an Engineering Department of 50 men. I am now classified as an Engineering Aide and I'm very, very happy not only because of my salary but because I am in the center of a scene as dramatic as the Gold Rush of '49 and as hectic as a train terminal at 5 o'clock. I am able to feel directly valuable to the war effort and most important of all, I have found the groove into which I fit. (Bureau of Training U.S. War Manpower Commission, 25)

Women were the most important group of non-traditional recruits and the classes given not only aided the war effort, but they also granted the opportunity to some women who might not have normally tried the chance to learn they could succeed in higher education. The only other group of non-traditional students with a measurable impact were blacks, and although their enrollment figures were low there are a variety of societal and educational factors which provide explanation.

Black Americans

The suppression of discrimination based upon sex removed the barrier to participation for the largest amount of people, but the ban of discrimination based on race was also a highly progressive maneuver for a national fighting a war with a segregated military. Yet even with the opportunity open, the number of black Americans who trained in the program only amounted to 25,158 and this low number can be attributed to several factors. First, although the program barred discrimination based on race it did not force

⁶⁴ Ibid

schools to integrate their classes beyond what law required. The *Answers to Questions* booklet published yearly always included the point that if schools are required by law to separate population groups then “to the extent needed for trainees of each such group, equitable provisions shall be made for facilities and training of like quality”.⁶⁵ This policy reflected the evasion of the 14th amendment sanctioned by *Plessy v Ferguson* (1896) which allowed “separate, but equal” public accommodations. This policy likely led to some schools turning away black students for a variety of made-up reasons or black students deciding not to enroll in such classes due to the likely inferior arrangements which would be provided.

Herman Branson was a black physicist and educator who published an article in the *Journal of Negro Education* in which he discusses his perceived reasons which caused black American enrollment to be so low. Branson explains how Pearl Harbor not only brought America into the war, but it also opened up America’s social, political, and economic life to black Americans in incredible new ways. He states that “Everywhere one met the belief that at last the integration of the Negro into American life was not a question of charity or abstract democratic principle but a necessity for the full mobilization of our most valuable war asset, manpower.”⁶⁶ His article’s analysis focused on the two popular programs for wartime industrial training, the ESMWT and the National Youth Administration (NYA). Where the ESMWT required classes to be of college level, the NYA only required grade school education and in 1942 alone had 58,228 black participants, a figure double that of

⁶⁵ United States, Federal Security Agency, U.S. Office of Education. (1944). “*Answers to Questions Pertaining To Engineering, Science, and Management War Training Program*”, 9.

⁶⁶ Herman Branson, “The Training of Negroes for War Industries in World War II,” *The Journal of Negro Education* 12, no. 3 (1943): 376.

the ESMWT program's entire black enrollment.⁶⁷ One of the reasons for this disparity in enrollment was the lower rate of educational attainment for blacks compared to whites. In April 1940 the percentage of black Americans who were high school graduates was only 7.7% while whites were almost triple with 26.1%.⁶⁸ Additionally, The college graduate level was even more disproportionate with 4.9% of whites having 4 or more years of college compared to only 1.3% of blacks.⁶⁹ A high school graduate level of education was the working minimum for the ESMWT program although most of the program required a college level education. Many blacks were thus ineligible for the classes, yet even the ones who were eligible faced additional difficulties in attempting to participate in training. The high requirements demanded by the ESMWT program for schools to offer the program's classes eliminated most black schools, although some schools were able to work around this by subcontracting through other institutions.⁷⁰ Additionally, where classes were able to be offered to black Americans there were often delays due to the need to bring black students up to the level of education required as their inferior and segregated high school education had not prepared them well enough, especially in the South. ESMWT training in the South was also at times sub-standard and there was clear evidence of inequality in training facilities which can be laid at the feet of local officials and their social prejudices. Classes "for Negroes" were offered at non-black colleges in the South, but these classes were almost never held there. Instead, as in the case of Alabama, they used the facilities

⁶⁷ Ibid, 377

⁶⁸ Thomas D. Snyder, *120 Years of American Education: A Statistical Portrait* (Washington, D.C.: U.S. Dept. of Education, Office of Educational Research and Improvement, National Center for Education Statistics, 1993), 18.

⁶⁹ Ibid

⁷⁰ Ibid, 384

located at traditionally black colleges elsewhere in the state.⁷¹ Some examples of black students' experiences with ESMWT courses in the South include situations like a class for "marine electricians in a shop where positively the only item of marine equipment was an eight-inch length of electrical cable" and "a class in motor mechanics where the students were forbidden to go into the motors".⁷² It is evident through examples like these two that the training for black Americans was hampered by a lack of respect for their abilities and likely the corruption of officials who misused the funding granted to them for these courses.

Branson places most of the blame for the ESMWT's lack of a significant number of black trainees on the program's strict requirements, the federal government's failure to train for national need instead of local, and the social prejudice of local officials which inhibited training. Branson also held the opinion that the program and black colleges had not done enough to recruit black Americans to the scientific aspect of the program and that merely training them on the technical aspect of how to operate the machines would "be certain to weaken us in the super-scientific world predicted for the post-war period".⁷³ There was a tendency among educators to track black Americans into these non-academic vocational fields which is likely one of the reasons the NYA, which dealt with more menial and trade fields, had such a greater amount of black enrollees.⁷⁴ Although the program may

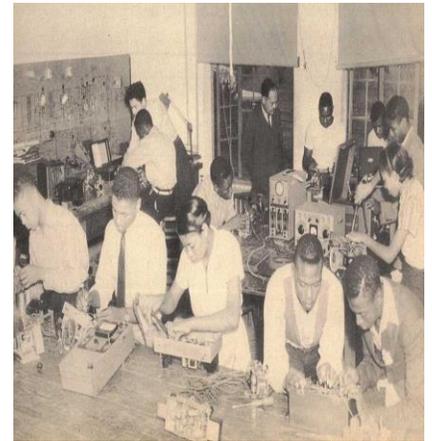


Fig. 4. One example of an ESMWT class offered at black colleges, in this example the students appear to be working on radios likely for a Radio Engineering or Radio Communication class.

⁷¹Ibid, 380

⁷² Ibid

⁷³ Ibid, 381

⁷⁴ Ibid, 376

not have been as successful as it could have, the final report of the ESMWT program stated that the training of blacks did create a “substantial contribution to the war effort” and they “contributed their full share to the industrial development of the country”.⁷⁵ Branson’s conclusion was that the underestimation and prejudice of the government towards black Americans' abilities meant that the government was throwing away “10 per cent of our potential technical brainpower”.⁷⁶ This underutilization and pigeonholing of black Americans into non-technical or academic occupations was not uncommon for this time period. It was just another example of the institutionalization of social prejudice and racism which was widespread within the United States and it clearly plagued the best efforts of black enrollees in the ESMWT program. Despite all the obstacles in their path, those who successfully participated in the program were said to have made a substantial contribution.

Impact and Importance

The End of the Program

There had been the hope that the ESMWT program would have continued post-war. The people participating in the program had been trained to fulfill roles in defense industries and with the general demobilization it was believed that the trainees would have to be retrained for peacetime activities such making automobiles, highways, or household appliances.⁷⁷ Additionally, the program had only created “large numbers of partially trained engineers and supervisors” and these would require further training if they were to

⁷⁵ U.S. Office of Education and Henry H Armsby, *Engineering Science and Management War Training, Final Report*, 46.

⁷⁶ Branson, “The Training of Negroes,” 382

⁷⁷ U.S. Office of Education and Henry H Armsby, *Engineering Science and Management War Training, Final Report*, 61

do more than simply fill their designated role.⁷⁸ Instead, the decision to end the program was made quite quickly and in January 1945 a telegram was sent to each participating institution alerting them that the program would cease operation on June 30th. Instructions were also sent detailing what each institution needed to do, and the liquidation was completed quickly and smoothly. It wasn't until a week after the official closing of the program that institutions learned they would be allowed to keep the equipment from the ESMWT program, provided that the school was using it "in its educational or training program".⁷⁹ The advisor and committee member positions for each region were no longer needed, the supplies and equipment were liquidated, and after a final audit and collection of reports the Engineering, Science, and Management War Training program ceased to exist.

It is difficult to easily explain the enormous contribution the ESMWT program made to the war effort, because it was often made in immeasurable means. Each person trained to fulfill a technical, scientific, or supervisory position not only directly increased output through their own work, but also indirectly through the increased efficiency of other employees thanks to their presence and training. The intense and rapid modernization of the United States Armed Forces could not have been accomplished at the pace and scale they were if not for the ESMWT program and other defense training programs. The mechanized forces required for the war could only have been produced through the sustained strong industrial output which the ESMWT program helped facilitate. Armsby makes this fact clear multiple times in his report through numerous quotes taken from

⁷⁸ Ibid, 62

⁷⁹ Ibid, 41

industrial executives about the benefits their plants and industries gained through ESMWT training of personnel. As further proof that the ESMWT program did in fact make a strong contribution to the war effort, a study was conducted in 1944 which found a correlation “positive and large enough to be regarded as significant”.⁸⁰ The success of the program led federal officials to clearly see the value of an educated population which could be utilized in emergencies to fill needed technical and scientific positions in both civilian and military components.

Long-term Importance

The greatest impact that the ESMWT program had was not on industry or the war effort, but on the people. 1.5 million men and women were given the chance to return to school and take college level classes again, or in some cases for the first time. They were able to work in their relevant industries and receive training to improve and develop their skills at the same time. Some who had not tried before were surprised that they were able to succeed in higher education as they had thought themselves not capable. The program helped renew general interest in higher education, especially in technical fields like engineering amongst both men and women. Before the war and the ESMWT program female engineers had been rare and a curiosity, but with dozens or even a hundred women appearing in the engineering departments it showed educators that “women could enter engineering in significant numbers” and that they could succeed.⁸¹ More generally, the number of total engineering undergraduates rose to 230,000 in 1947 which was 10 percent

⁸⁰ Ibid, 133

⁸¹ Bix, “Girls Coming to Tech,”, 93.

of the entire enrollment across higher education that year and no doubt was influenced both by the success of the engineering portion of the ESMWT and the G.I. Bill.⁸²⁸³

G.I. Bill and Industry

Even before the end of the war the United States was preparing itself for possible future conflicts and it was clear that strong scientific and industrial power of a nation would be critical for success in modern warfare. This is likely a reason why the Servicemen's Readjustment Act of 1944, or the G.I. Bill included such generous financial assistance for veterans seeking advanced education. The ESMWT program had also fostered a close relationship between the higher education institutions and the government which no doubt helped pave the way for federally sponsored education. The pattern set by the ESMWT program saw institutions retaining their fundamental autonomy while training personnel using federal funds and that this method produced strong results. The G.I. Bill likely included these educational benefits because, among other programs, the ESMWT had shown "adults can be educated and that such education pays".⁸⁴ The G.I. Bill was not just a reward for returning veterans thanking them for their service, but it was an investment by the government into the population. The ESMWT program was a three-part relationship between higher education, the federal government, and industry. While the G.I. Bill was primarily a relationship between the first two, industry also benefited from the educational benefits. The wartime industrial efforts had revitalized the economy which had before been slowly recovering from the Great

⁸²Snyder, *120 Years of American Education: A Statistical Portrait*, 77

⁸³ J. R. Perry, S. D. Sturgis, Brehon B. Somervell, and Lee B. Washbourne. "Engineer Shortage and National Security—II: DISCUSSIONS." *The Military Engineer* 46, no. 314 (1954): 437-39.

⁸⁴ U.S. Office of Education and Henry H Armsby, *Engineering Science and Management War Training, Final Report*, 65.

Depression. Corporations made massive profits as “merchants of death” and even those not directly involved in munitions and weapons were able to buy former GOCO facilities for a fraction of the price they were built for. It was clear to industries, given the results of the ESMWT training on their employees, that “the colleges can conduct the kind of courses needed by industry, more effectively than industry can conduct them for itself, and with less interference with production”.⁸⁵

Conclusion

People, industry, and higher education had all answered the nation’s call for mobilization and worked together for a common purpose. Individuals benefited through the knowledge gained by schooling and were given purpose and a way to assist their nation in war, even without wielding a weapon. Women were able to prove themselves in technical and scientific fields which they had previously been scoffed at for even considering. Corporations and industry worked with the federal government to create the Arsenal of Democracy and a dual victory was achieved monetarily and in war. Industries were able to train their employees through universities and colleges utilizing federal funding to increase the output and efficiency of their factories.

Higher Education was finally able to achieve its past goal of assisting in the war effort and proving that it was necessary for defense. In return, the universities and colleges received millions of dollars worth of equipment for free and through their training, helped spark a new interest in schooling for millions of Americans. This in addition to the G.I. Bill led to record enrollments in the years following WW2. Even though the ESMWT program was short-lived the impact it had and the lessons that could be

⁸⁵Ibid, 66

learned through further study of it remain as relevant today as they were then. The ESMWT program was an experiment which saw unprecedented success in almost every way. Each component which took part in the program experienced both tangible and often unseen gains. The United States had actively learned from its past failures and, in a time of great need, created a program which positively impacted everything it touched. If the need for a similar program should ever arise again, then there is no better example to follow than that of the massively successful and impactful ESMWT program.

Bibliography

- Armsby, Henry H. "ESMWT." *The Journal of Higher Education* 15, no. 2 (1944): 86-94.
<https://doi.org/10.2307/1975263>
- Bix, Amy. *Girls Coming to Tech!: A History of American Engineering Education for Women*.
London: MIT Press, 2014.
- Branson, Herman. "The Training of Negroes for War Industries in World War II." *The Journal of Negro Education* 12, no. 3 (1943): <https://doi.org/10.2307/2293057>.
- Cardozier, V. R. *Colleges And Universities In World War II*. Westport, Conn.: Praeger, 1993.
- Erenberg, Lewis A, and Susan E Hirsch. *The War in American Culture: Society and Consciousness during World War II*. Chicago and London: University of Chicago Press, 1996.
- Jeffries, John W. *Wartime America: The World War II Home Front*. Chicago: Ivan R. Dee, 1996.
- Layne, Margaret *Women in Engineering: Pioneers and Trailblazers*. Reston, VA: American Society of Civil Engineers, 2009.
- Lykes, Richard Wayne. *Higher Education And the United States Office of Education (1867-1953)*. Washington: Bureau of Postsecondary Education, United States Office of Education, 1975.

Olsen, Herluf V. "National Defense and the Collegiate Schools of Business." In *American Association of Collegiate Schools of Business Proceedings of the 23rd Annual Meeting*. University of Minnesota, 1941.

Perry, J.R., S. D. Sturgis, Brehon B. Somervell, and Lee B. Washbourne. "Engineer Shortage and National Security—II: DISCUSSIONS." *The Military Engineer* 46, no. 314 (1954)

Snyder, Thomas D. *120 Years of American Education: A Statistical Portrait*. Washington, D.C.: U.S. Dept. of Education, Office of Educational Research and Improvement, National Center for Education Statistics, 1993.

U.S. Department of State. *Peace and War: United States Foreign Policy, 1931-1941*. , Publication 1983. Washington, D.C.: U.S. Government Printing Office, 1943.

U.S. Office of Education. *Engineering Science and Management War Training, Final Report*. Henry H. Armsby. Bulletin 1946, No. 9. Washington, DC: U.S. Government Printing Office, 1946.

Westbrook, B. Robert, *Why We Fought: Forging American Obligations in World War II*. Washington, DC: Smithsonian Books, 2004. ProQuest Ebook Central.

Wilson, Mark R.. *Destructive Creation : American Business and the Winning of World War II*. Philadelphia: University of Pennsylvania Press, 2016. ProQuest Ebook Central.

Fig. 1, *Engineers Blaze the Trail for Education! The engineers can place men from 18 to 40 where they can learn their trade in the Army*. 1919. Poster, lithograph color. Library of Congress Prints and Photographs Division, Washington D.C,

<https://www.loc.gov/pictures/collection/wwipos/item/00651599/>

Fig. 2, Falter, John. *"Sacrifice for Freedom"*, Poster, World War II Propaganda (U.S. Government Printing Office, 1942)

Fig. 3, "FEW COLLEGE GIRLS TAKE WAR COURSES: SURVEY SHOWS ONLY 26% IN THIS AREA AND UP-STATE ARE TRAINING TO REPLACE MEN WARNING BY DR. NEWMAN FREE ELECTIVE SYSTEM WILL HAVE TO GO IF WAR LASTS VERY LONG, HE SAYS." New York Times (1923-Current File), Jan 11, 1943.

<https://www.proquest.com/docview/106530113/102FCCD92A7A4859PQ/1>

Fig. 4, *War Training*. 1943. Panther CIC Historical Images Gallery, Prairie View A&M University, Prairie View TX. Accessed September 28th, 2020.

<https://www.pvamu.edu/panthercic/pv-legacy7/>