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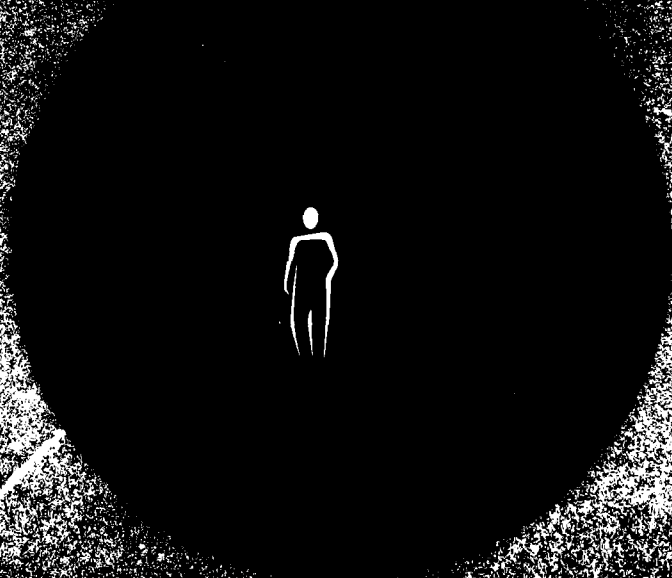
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**THE LONG-RANGE ROLE AND
MISSION OF INSTRUCTIONAL
PROGRAM DEVELOPMENT
CENTERS: ECONOMIC
ASSESSMENT**

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TAEG Report No. 103

THE LONG-RANGE ROLE AND MISSION OF INSTRUCTIONAL
PROGRAM DEVELOPMENT CENTERS: ECONOMIC ASSESSMENT

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Training Analysis and Evaluation Group

June 1981

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20. Abstract (continued)

→ The specific objectives were:

- . document the resources expended by functional areas of the ISD model;
- . identify factors, contingencies, and problems encountered in the IPD effort which impact on efficiency;
- . provide an objective data base from which productivity estimates can be derived for planning;
- . provide data which can be used to aid in developing a more cost-effective management plan for future IPD efforts;
- . identify areas which could be investigated as to the feasibility for improving efficiency and operation of the IPDC effort.

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SECTION I

INTRODUCTION

The Navy formally implemented Instructional Systems Development (ISD) in July 1976 with the establishment of an Instructional Program Development Center (IPDC) at San Diego. Since that date, considerable resources have been committed to the Navy's IPD effort.

There has been continuing concern about the efficiency and effectiveness of the IPDC network and a recognized need for a long-range plan. Consequently, the Training Analysis and Evaluation Group (TAEG) was tasked by the Chief of Naval Education and Training (CNET) to investigate the long-range role of the IPDC in the outyears. The tasking stated that "particular attention should be paid to the class 'C' and 'F' schools and to the cost effectiveness of the current and planned IPD center network."¹ Neither the cost effectiveness of the ISD process nor the adequacy of the IPDCs performance was the central issue of the study.

The task was divided into two phases. Phase I documented the costs, output, and problems of the IPDCs from their establishment in 1976 through September 1980. Phase II of the study addressed issues dealing with the improvement and efficiency of the IPD effort. Data from both efforts will support the development of a command-wide plan for developing and maintaining instructional material for all "A," "C," and "F" courses.

This report is the phase I study. Detailed analyses emphasize the economic aspects of the course development and implementation process as it occurred between July 1976 and September 1980. The study results also provide inputs to the phase II effort. The phase II effort will be reported in a separate document. Work on the project began in mid-1980 but was delayed in order that the analysis could include all of the FY 80 data. The FY 80 data was received in December 1980.

PURPOSE

The purpose of the present study was to provide empirically-based factors which could be used to develop a realistic long-range plan for the orderly implementation and efficient management of the Navy's IPD effort. Specific objectives were:

- . document the resources expended by functional areas of the ISD model
- . identify factors, contingencies, and problems encountered in the IPD effort which impact on efficiency
- . provide an objective data base from which productivity estimates can be derived for planning

¹CNET (N-53) tasking ltr of 21 Feb 1980, subj: Tasking for a study of the long range role and mission of Instructional Program Development Centers (IPDC's).

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- provide data which can be used to aid in developing a more cost-effective management plan for future IPD efforts
- identify areas which could be investigated as to the feasibility for improving efficiency and operation of the IPDC effort.

BACKGROUND

The CNET in January 1975, directed a study group to develop a plan for the full implementation of ISD using a centralized management concept. This study group developed and published a comprehensive plan² (subsequently called the "Blue Book") which set forth an approach for implementing the ISD procedure, published as NAVEDTRA 106A.

The comprehensive plan called for the ultimate establishment of five IPDCs to develop instructional programs for all NAVEDTRACOM courses. The Blue Book provided a plan for the management and organizational structure of the five IPDCs and an orderly procedure for the transition of course curriculum development and maintenance into the IPD program over a 12-year period. The Blue Book called for a two phased effort. During phase I, the ISD process was to be applied to the 193 high-volume indoctrination and basic skill courses. Phase II called for the application of ISD to the remaining 2,000 plus courses representing advanced skill training and system-specific courses.

This plan was based upon a set of assumptions and constraints on resource availability and productivity rates. These assumptions were derived from data obtained from previous ISD-like efforts in CNET and from industry experience. The funding requirements for the plan represented an estimate of resources required for full implementation of the CNET decision to utilize the ISD procedures and to phase in all course development into the IPD effort.

The CNET decision to implement the ISD program was supported by three economic analyses performed between November 1975 and July 1977.^{3,4,5} These analyses were based upon a number of tentative assumptions dealing with the rate and resources required to develop course curricula using the ISD model.

²Chief of Naval Education and Training Support memorandum O1A:ELL of 11 Aug 1975, subj: Plan for the Implementation of ISD in NAVEDTRACOM.

³Economic Analysis of the Instructional Systems Development Plan, TAEG Technical Memorandum 75-6, 3 November 1975. Training Analysis and Evaluation Group, Orlando, FL 32813.

⁴Morris G. Middleton, William M. Swope, William C. Rankin, Eric K. Green, and William F. Parrish. Cost/Benefit Analysis of the Instructional Systems Development Implementation Plan (FY 77 to FY 82). TAEG Technical Memorandum 76-7, November 1976. Training Analysis and Evaluation Group, Orlando, FL 32813.

⁵William M. Swope and Eric K. Green, Cost/Benefit Analysis of the Instructional Systems Development Plan. TAEG Technical Memorandum 77-6, July 1977, Training Analysis and Evaluation Group, Orlando, FL 32813.

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These analyses generally demonstrated that the Naval Education and Training Command (NAVEDTRACOM) plan for implementation of the IPD effort would indeed result in a reduction of total training costs, especially for the first few years when the high throughput courses were brought under development.

A number of assumptions were necessary for the above economic analyses and these were fully documented in the referenced technical memorandums. Two of the most crucial assumptions which impacted heavily on the conclusions drawn from the economic analyses were: (1) each fully funded IPDC would be able to develop 1,000 hours of instructional material per year and (2) courses developed using the ISD process would result in an average 10 to 15 percent reduction in student training time. The previous economic analyses did not address the question of differential training effectiveness resulting from the application of the highly structured ISD process. It was assumed that training effectiveness would be at least equal to or "better" using the IPD-developed materials. Using the latter assumption, it was demonstrated that it would be economically efficient to adopt the proposed IPD implementation plan. This conclusion was justified entirely on the basis of the projected saving of student training time.

Experience to date, although limited, indicates that some of the assumptions made in the previous analyses are not tenable. For example, the time required for developing course curricula using the highly structured ISD process is much greater than anticipated. Also, indications are that in the long run the application of the ISD process may not lead to an average reduction of 10 to 15 percent in student time primarily because of the need to add new material to the revised course to satisfy validated task requirements. The economic feasibility of the highly structured ISD process must depend on demonstrating that the application of this process leads to "more relevant" or more effective training. Whether or not the potential benefits which might be derived from more effective training are worth the additional costs is a management decision.

Curriculum development is a necessary part of training. There is no essential agreement on just how and where that development should be organized and completed. The ISD procedures represent an orderly process for developing curriculum, but where that development is to be done and by whom are not addressed in the ISD model. The implementation of the ISD model can occur on a continuum represented at one end by a highly decentralized developmental effort concentrated at the school. The other end of the continuum is represented by a highly structured organization where resources are devoted exclusively to developing curriculum using the ISD models. Prior to the IPD effort the Navy depended on the local training organization to develop its own training program and curriculum. The products often were judged inadequate and suspected of not providing the most cost-effective training. Local curriculum development costs appeared to be low; however, these costs were usually confounded with other training costs which makes it difficult to isolate the unique curriculum development costs.

In 1976, with the formalization of the IPD effort in the IPDCs, the Navy moved toward a highly structured organizational approach to implementing ISD. To date, the productivity and effectiveness of these IPDCs are less than anticipated. A part of these deficiencies may result from inefficiencies

inherent in the implementation of any new and untried program. However, because of the complexity of a full-scale curriculum development program, it may simply be more expensive to develop curriculum than originally anticipated. In addition, when curricula are developed in an organization devoted entirely to that purpose then costs incurred are fully exposed, identifiable, and become totally incremental for that decision.

It is difficult to determine how much more expensive, if any, a curriculum developed at an IPDC is over a similar curriculum developed on a more ad hoc basis at the schoolhouse. This difficulty can be attributed to two major factors. First, it is almost impossible to establish unambiguously total curriculum development costs at the schoolhouse because so many of the resources required for curriculum development are jointly used for other parts of the training program. To estimate total curriculum development costs would require one to allocate these joint overhead costs among the various training functions.

Fortunately, management decisions regarding curriculum development costs do not require one to estimate total costs at the schoolhouse. The appropriate and relevant cost information required by management is the incremental costs; i.e., how costs will change if the curriculum development function is added or removed from the schoolhouse. Therein lies the second difficulty. To estimate incremental costs it is necessary to determine the value in alternative uses (opportunity costs) of the resources which are currently devoted to curriculum development. The problem of estimating costs for individuals who develop curriculum is especially difficult. Many of these individuals have other duties and removing their responsibility for curriculum development often will not eliminate their billets because of these additional duties. For example, an instructor may be required to be onboard even though he teaches only 50 percent of the time. If he is presently doing curriculum development then his time may, in fact, be "free" when computing the economic development costs. If the curriculum development function is removed, he may be forced to do trivial or nonproductive work to fully utilize his time.

APPROACH

As indicated earlier, TAEG was tasked to examine the question of which most efficient and effective organizational and management structure for continued implementation of a highly structured IPD capability within the Navy. A return to the pre-ISD/IPDC status quo was not considered an option. Since the tasking explicitly stated that "particular attention should be paid to class 'C' and 'F' schools and to the cost-effectiveness of the current and planned IPD center network,"⁶ it was necessary to examine the past performance of the IPDCs in terms of the utilization of resources and the rate at which instructional material was being developed. This examination involved an analysis of the cost and manpower data bases being maintained by the IPDCs and other empirical data collected directly from the IPDCs.

Visits were made to the major IPDCs to obtain a qualitative summary of problems which impact on the productivity of each center. Situation summaries,

⁶OP cit. CNET N-5 tasking ltr of 21 Feb 1980.

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TABLE 8. PERCENTAGE DISTRIBUTION OF ALL IPDC TIME AMONG THE ISD FUNCTIONS--SAN DIEGO (1976 to 1980)

Function	1976*	1977	1978	1979	1980*
Administration	59.5	59.5	55.5	57.0	53.0
Analyze	20.8	15.5	16.8	11.8	4.5
Design	3.5	3.1	3.6	6.3	5.3
Develop	5.5	11.0	15.4	16.1	26.3
Media	0.5	7.2	3.7	4.7	6.7
Evaluation	0.0	0.7	2.1	1.9	3.0
Training	9.9	2.5	2.5	1.8	0.9

*Not a full year

TABLE 9. PERCENTAGE DISTRIBUTION OF IPDC TASK TIME ASSIGNED TO THE ISD FUNCTIONS - SAN DIEGO (1976 to 1980)*

Function	1976	1977	1978	1979	1980
Administration	19.6	19.3	21.6	17.1	15.3
Analyze	54.6	32.5	31.3	23.6	8.3
Design	9.5	6.7	6.8	12.6	9.6
Develop	14.8	23.1	28.6	32.3	48.3
Media	0.6	15.0	6.9	9.4	12.3
Evaluation	0.0	1.6	3.9	3.8	5.5
Training	0.6	1.5	0.5	0.9	0.4

* Excludes time assigned to nonIPD functions, leave, and nonidentified tasks.

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to tasks supporting that rating. If for any pay period the equivalent number working on the task exceeded nine individuals then the number was coded with an appropriate symbol as given in the legend on the figure. For example, during the last pay period shown in 1980, the equivalent of four individuals were working on the RT rating, three on the SA rating, one on the GT rating, nine on the HT rating, four on the EO rating, nine on the RM rating, and four on the IC rating. The ST and DP ratings were coded as an "A" which indicated that the equivalent of 11 to 19 individuals were working on each of these ratings. Finally, the last row, "OH" is the administrative overhead. The time attributed to administration during the last period shown was coded as "D" which indicated that there was the equivalent of 40 to 49 individuals assigned full time to the administration functions/duties. This figure illustrates the distribution of the work effort over the period illustrated and shows which ratings were being emphasized in each pay period (in terms of the IPDC's work effort) over the entire life of the center. During 1979 there were more tasks underway than for any of the other years as indicated by the number of tasks to which manpower was allocated.

The distribution of labor among the IPDC functions, as a percent of the total available to the IPDC, is shown in table 8. In each year more than half of the available time was assigned to functions classified as administration. There has been a steady decrease in the percentage (of the total time available) which has been attributed to analysis and a steady increase in the percentage attributed to development. This change in emphasis can, with a high probability, be attributed to the phasing of work under development. The San Diego IPDC has not been in existence long enough to attain a steady state in the composition and phasing of tasks under the various stages of ISD. In the long run, the distribution of work among the ISD phases in the IPDC may prove to be cyclical as new tasks are phased in and others completed.

The major reason that so much of the IPDCs time has been assigned to administration arises from the large amount of time attributed to nonIPD and nonidentified tasks. Most of the time attributed to these latter two categories was assigned to the administrative function. If the nonIPD functions, leave, and nonidentified tasks are excluded from the distribution of time, then the amount of total administrative time used in support of the assigned tasks varies from a high of 21.6 percent in 1978 to a low of 15.3 percent in 1980 (table 9).

The trend in administration as a percent of all IPDC time is illustrated in figure 1. The figure shows the trend in administration time used in direct support of the assigned IPD tasks. There appears to be a slight downward trend in percent of total time devoted to administration.

Given a fixed labor base, the rate at which the IPDCs can develop the courses assigned for ISD will be affected by the proportion of time allocated to the nonIPD and nonidentified tasks, especially if those tasks are not in support of the courses assigned the IPDC for development. In 1976, 50 percent of the total IPDC time was assigned to other nonIPD or nonidentified tasks (table 10). There has been a fairly steady decline in this percentage since the establishment of the IPDC as illustrated in figure 2. In 1980 an estimated 34 percent of the time was devoted to nonIPD and nonidentified tasks.

The distribution of time among the functions for a selected set of ratings is shown in appendix B (tables B-1 through B-7). The man-hour and percentage of the total time assigned during each two week period over the life of the project is displayed in the appendix tables. As expected, most projects have a large percentage of project time assigned to administration during the first few accounting periods. Analysis tends to be heavy during the beginning periods of the task, but it also appears that during the life of most projects that there are subsequent periods when a significant part of the effort is shifted back to analysis. The phasing of the work effort among the ISD blocks seems to have occurred in a fairly linear sequence for most tasks presented in appendix B.

A distribution of the work effort over the various ratings assigned to the San Diego IPDC is shown in figure 3. The distribution is shown by each two-week pay period starting from the 12th pay period in 1976 and ending with the 20th pay period in 1980. The vertical columns at each pay period indicate the equivalent number of employees (or man-periods) working on tasks associated with each of the ratings. Each man-period represents 80 hours of time assigned

TABLE 7. MAN-HOURS ATTRIBUTED TO EACH ISD FUNCTION AT THE
SAN DIEGO IPDC (1976 to 1980)

Year	Administration	Analyze	Design	Develop	Media	Evaluation	Training	TOTAL
1976*	36,065	12,654	2,149	3,352	326	0	6,006	60,552
1977	145,423	38,025	7,810	26,965	17,749	1,912	6,225	244,109
1978	147,859	44,823	9,834	40,979	10,038	5,621	6,873	266,027
1979	156,350	32,440	17,427	44,386	13,015	5,349	5,034	274,001
1980*	104,799	8,965	10,523	51,989	13,344	5,957	1,938	197,515
TOTAL	590,496	136,907	47,743	167,671	54,472	18,839	26,076	1,042,204

*not a full year

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Table 6 shows a summary of the distribution of man-hours reported by the IPDCs since their establishment. Seventy-two percent of the time has been attributed to course development, but only 45 percent of the total hours have been directly attributed to the analysis, design, development, and validation of instructional materials. Indirect course development support (made up largely of nonidentified tasks) and nonIPD tasks accounted for approximately 48 percent of the total labor reported during the period 1976 to 1980. In general, the man-hour accounting instruction directs that employees occupying billets which are not IPD dedicated but who work on IPD tasks will assign that portion of their time they are not working on IPD tasks to the nonIPD category.⁹ It is not clear whether the time has been appropriately assigned per the instruction. There was some indication that at least a part of the time assigned to the nonIPD category was under the management control of the IPDCs.

TABLE 6. PERCENTAGE DISTRIBUTION BY SELECTED CATEGORIES FOR MAN-HOURS COMMITTED TO THE IPDCs (1976 to 1980)

<u>Category</u>	<u>Percent</u>
Course Development	72
Direct	45
Indirect	27
Course Maintenance	5
NonIPD	21
Other	2
TOTAL	100

SAN DIEGO IPDC. An analysis of the labor utilization at the San Diego IPDC from July 1976 to September 1980 is described next. The analysis is limited to the San Diego IPDC since it is the only site which has been in operation long enough to establish any trends. Even this site has relatively few data points from which to estimate trends. Another reason for limiting the analysis to the San Diego site is that a complete set of data showing a detailed functional breakdown of how labor was used is readily available and in a format adaptable for automated data analysis.

The total man-hours expended by the IPDC are shown in table 7. The man-hours shown for 1976 are for less than a full year since the site was not established until July of that year. Similarly, the data for 1980 includes only the first 9 months; i.e., through September 1980. The labor used by the IPDC has increased from 60,552 hours in 1976 to a projected level of 270,000 hours for 1980 and has not changed significantly in the last two years.

⁹CNETSUPPORTINST 7400.1 Code N62 of 27 Jun 1978, subj: Man-hour Accounting for Instructional Program Development (IPD): policy and procedrues for.

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5 was 308 hours per original course hour.⁸ Design and development of the course materials accounted for 34 percent of the time. Indirect labor accounted for 37 percent of the total labor used. Indirect labor includes training and orientation time of new employees, administrative support, leave time, and miscellaneous unidentified tasks. Miscellaneous unidentified tasks accounted for 24 percent of the total labor costs as determined from the detailed man-hour accounting data available. The indirect category does not include typing, audiovisual support, or any other support which could be directly related to each task. The "other" category includes specific tasking of a general nature including, but not limited to, tasks which attempt to develop improved procedures for executing the ISD model.

TABLE 5. MAN-HOURS REQUIRED PER HOUR OF ORIGINAL INSTRUCTION FOR SELECTED RATINGS DEVELOPED AT THE NAVY IPDCs*

Rating	Analysis	Design/ Development	Other***	Indirect	Total
RM	19	131	65	110	325
IC	93	301	98	252	744
ST	63	92	42	101	298
ET	32	54	22	53	161
HT	24	65	13	52	154
EM**	31	92	94	104	321
FA**	8	113	103	106	330
EO	12	44	17	38	111
DP	61	85	28	89	263
SA	15	275	88	194	572
AA	27	247	138	351	763
Average****	40	106	47	115	308
Percent of Total	13	35	15	37	100

* All instructional material for the above ratings is complete or nearing completion. For those still incomplete, an estimate was made of man-hour requirements. The EM, SA, and AA were significantly increased in length which biases upward the per hour labor estimates.

** Does not include labor services included in contractual support.

*** Other includes time which was in direct support of the course but not elsewhere classified.

**** Weighted by hours developed for each course.

⁸The average labor requirements for the same set of ratings, when computed using revised hours, were slightly lower at 298 manhours per revised course hour.

TABLE 4. LABOR COSTS INCURRED IN THE DEVELOPMENT OF 12 SELECTED RATINGS

Rating	Labor Costs (\$1,000)		Total	Equivalent Hours		Labor Cost Per Hour	
	Military	Civilian		Original	Revised	Original	Revised
RM	\$ 48.4	\$ 838.0	\$ 886.4	396	396	\$ 2,238	\$ 2,238
IC	212.3	1,388.8	1,601.1	284	242	5,638	6,616
ST	126.7	536.1	662.8	300	270	2,209	2,455
ET	189.8	560.0	749.8	772	765	941	980
HT	62.7	258.1	320.8	311	281	1,031	1,142
EM*	19.1	273.3	292.4	149	225	1,962	1,299
FA*	37.2	431.5	468.7	85	140	5,076	3,348
EO	95.7	101.8	197.5	230	230	859	859
DP	180.8	315.0	495.8	287	258	1,728	1,922
SA	55.3	325.4	380.7	85	140	4,479	2,719
AA	47.2	340.7	387.9	85	140	4,564	2,771
BE&E	0	126.2	126.2	91	90	1,387	1,402

*Contract supported

and IT). Twelve ratings assigned to the IPDCs were sufficiently complete to estimate development costs. The development costs per revised course hour for these 12 ratings ranged from \$1,461 for the E0 rating to \$12,686 for the IC rating. The average cost per revised course hour was \$4,635. The average cost per original course hour for those 12 ratings was only slightly higher at \$4,970. Appendix A provides a summary of course characteristics for courses completed or nearing completion. Much of the variation in development costs can be attributed to the scope of the tasking and the characteristics of the instructional material being developed. Therefore, the costs experienced for any given course must be judiciously interpreted in conjunction with the tasking and the product. If a new course is significantly different in length from the old course, the development cost per original course hour will be biased in terms of cost per hour of new material developed. Although cost stated in terms of the new course material would be preferable for auditing purposes, the costs in terms of the old course length are more useful for projecting expected development costs. These average development costs appear to be within an acceptable range as determined from previous experience. Furthermore, the average costs were not significantly different whether stated in terms of the old course length or new course length. However, there was considerable variability among the costs for the various ratings.

Labor costs for the 12 ratings are shown in table 4. Labor costs have accounted for 45 percent of all noncontract IPD expenditures. (See table A-6, appendix A.) The most potential for improvement in the productivity rates of the IPDCs will come from the utilization of labor, because other expenditures are largely determined by course characteristics. Since labor costs account for 45 percent of all noncontract expenditures, the potential for improvement in total productivity is somewhat constrained.

MANPOWER UTILIZATION

OVERVIEW. The man-hours utilized for revising the instructional material for the ratings which are substantially complete are presented in table 5. The man-hour requirements are based on the number of hours required for development per original course hour.⁷ It would conceptually be more appropriate to state the labor utilization rates in terms of the hours of instructional material developed, but those rates would be of little value for planning purposes since the number of hours in the new course are not known until the course is developed. Justification for utilizing present course lengths stems from the fact that present course lengths are reasonably reliable predictors of the newly developed course lengths. Furthermore, it has often been dictated by administrative fiat that the new course must not be longer than the original course and new material has almost always ensured it will be nearly as long.

The labor required per original course hour varied from 111 hours for the E0 rating to 744 hours for the IC rating. The average labor requirement (weighted by hours developed for each course) for the ratings listed in table

⁷Original course hours are determined by the course length in group-paced courses and by average completion time in self-paced courses. The estimates are based on the length of course before development.

TABLE 3. INSTRUCTIONAL MATERIAL DEVELOPMENT COSTS PER HOUR FOR SELECTED RATINGS

Rating	Total Expenditure \$1,000	Contract Hours		Equivalent Hours Complete		Cost Per Equivalent Hours	
		Original	Revised	Original	Revised	Original	Revised
RM	\$2,082	396	396	396	396	\$5,260	\$5,260
DS***	357	931	ID	ID*	ID	-	-
IC	3,197	295	252	284	242	11,257	12,686
ST	1,111	300	270	300	270	3,703	4,115
ET	2,145	848	840	772	765	2,778	2,804
EW	7,175	**	ID	ID	ID	ID	ID
HT	581	426	385	311	281	1,868	2,068
EM	1,523	213**	322	149	225	10,221	6,768
FA	1,544	85**	140	85	140	18,165	11,028
EO	336	240	240	230	230	1,461	1,461
CM	61	355	355	ID	ID	ID	ID
UT	103	298	298	ID	ID	ID	ID
EA	35	312	312	ID	ID	ID	ID
BU	29	251	251	ID	ID	ID	ID
SM	20	365	365	ID	ID	ID	ID
CC	5	217	217	ID	ID	ID	ID
DP	897	312	280	287	258	3,125	3,477
SA	831	85	140	81	134	10,259	6,201
AA	726	85	140	81	133	8,963	5,459
FT****	81	455	385	ID	ID	ID	ID
BE&E	267	New	91	90	90	2,967	2,967
CT	2,122	**	**	ID	ID	ID	ID
IT	1,186	**	**	ID	ID	ID	ID
RT	54	-	-	ID	ID	ID	ID
MM	4	190	190	ID	ID	ID	ID
BT	5	240	240	ID	ID	ID	ID
PE	133	125	125	ID	ID	ID	ID
GM	18	252	252	ID	ID	ID	ID
Existing	2,965	-	-	-	-	-	-
Other	1,533	-	-	-	-	-	-
Total	\$31,156	7,276	7,276	3,066	3,066	4,970	4,635
Average	-	-	-	-	-	-	-

*** Analysis Only
****Phase I Only

* ID = Insufficient Data
**Contract Supported

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TABLE 2. RELATIONSHIP OF COURSES AND CONTACT HOURS TO THE PERCENT OF TOTAL TRAINING DAYS FOR ALL NAVEDTRACOM COURSES*

<u>Cumulative Number of Courses</u>	<u>Cumulative Training Days (1,000)</u>	<u>Percent of Total Training Days</u>	<u>Cumulative Contact Hrs</u>	<u>Percent of Total Hrs</u>
7	820	5	227	0.04
15	1,640	10	622	0.11
24	2,461	15	1,630	0.30
28	3,281	20	1,842	0.34
34	4,101	25	2,613	0.48
48	4,921	30	4,420	0.82
62	5,742	35	6,478	1.20
90	6,562	40	9,662	1.79
110	7,382	45	12,846	2.38
129	8,202	50	17,490	3.25
151	9,023	55	21,500	3.99
181	9,843	60	26,508	4.92
231	10,663	65	35,001	6.49
310	11,483	70	47,899	8.89
417	12,303	75	63,952	11.87
572	13,124	80	86,183	15.99
826	13,944	85	125,124	23.22
1,145	14,764	90	180,101	33.42
1,663	15,584	95	279,005	51.77
2,869	16,405	100	538,932	100.00

* Excludes Basic Military Training

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When past IPDC performance is compared to the task of applying the ISD process to the 539,000 contact hours in the 2,900 courses reported in NITRAS, the impossibility of accomplishing this task using a few highly centralized IPDCs is apparent. Though this limitation of the IPDCs capacity was recognized in the IPDC planning, the mechanics and resources for applying ISD to all Navy courses are still not available.

A summary of these courses, contact hours, and training days as computed from NITRAS data is contained in table 2. The courses have been ranked by throughput and the data cumulated for each 5 percent increment in total training days. For example, the first 129 courses represent approximately 8.2 million training days or 50 percent of the total training days and approximately 17.5 thousand contact hours or 3.25 percent of the total contact hours. (The distribution of training days and contact hours for the "A," "C," and "F" courses is shown in tables A-2, A-3, and A-4, respectively (See appendix A.))

Table 2 shows that a relatively large share of the total Navy training is represented by a relatively small share of the total contact hours. The IPD effort could be applied to 75 percent of total Navy training by developing only 12 percent of the total contact hours or 63,900 course contact hours. All of the courses making up the above 12 percent will not need major revision and by carefully selecting the courses for development a substantial part of Naval training can be developed without completely developing all courses. The most return for resources utilized at the IPDCs will be realized if those courses scheduled for development in the IPDCs are those courses which have a relatively high throughput and are the most deficient in meeting the current training objectives.

IPD EXPENDITURES

From the establishment of the IPDCs in 1976 through September 1980, the total IPD expenditures have exceeded \$31 million (table 3). These represent the actual budgeted expenditures and are considerably less than the actual taxpayer costs of the program. Much of the overhead costs are not included in these cost data. A total of \$7.2 million, or 23 percent of the total IPD resources, was expended on software development (and some minor equipment purchases) supporting the EW rating. Approximately \$2.2 million was committed for a software development contract to support EW. Much of the output of this software contract was of minimal value because the contract for hardware (for which the software was being developed) was terminated. Detailed expenditure and other summary data for each rating are shown in table A-5 (appendix A).

Nearly \$3 million was apparently devoted to supporting existing school programs and was not used in direct support for developing the instructional material for courses assigned to the IPDCs for development. The ratings listed in table 3 are listed by dates in which they were first tasked by CNET. There is no evidence from these data to indicate that productivity rates have been improving. However, variation in tasking, contract services, and the extent of the development effort would tend to obscure trends which might indicate changes in productivity rates.

The original 7,200 course contact hours scheduled for ISD at the IPDCs do not include those ratings which have been heavily contract supported (EW, CT,

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TABLE 1. COMPLETION STATUS FOR COURSES/RATINGS UNDER DEVELOPMENT AT THE IPDCS AS OF SEPTEMBER 1980

Rating	Percent Complete			
	Analysis	Design	Development	Validation
RM	100	100	100	100
DS	100	N/A	N/A	N/A
IC	100	95	95	95
ST	100	0-99	0-99	0-99
ET	100	85	85	85
HT	100	63	63	63
EM	100	60	60	0
FA	N/A	100	100	75
EO	100	95	95	95
CM	100	0	0	0
UT	100	46	46	46
EA	100	0	0	0
BU	100	0	0	0
SW	100	0	0	0
CE	100	0	0	0
DP	100	87	87	87
SA	N/A	96	96	96
AA	N/A	100	100	85
FT	60	10	10	0
BE&E	N/A	90	90	10
EW	*	*	*	*
CT	*	*	*	*
IT	*	*	*	*
RT	30	N/A	N/A	N/A
MM	35	8	8	0
BT	35	8	8	0
PE	75	30	30	0
GM	N/A	5	5	0

* Contract supported

SECTION II

ANALYSIS

This section includes:

- . an analysis of cost and productivity for developmental work completed and currently underway at the IPDCs
- . a summary of the IPDC expenditures for the 1976 to 1980 period
- . an analysis of the expenditure and output data to determine productivity and trends in development cost
- . an analysis of the utilization of manpower.

COURSES/RATINGS CURRENTLY UNDER DEVELOPMENT

The first tasking from CNET to the IPDCs was issued in May 1976. Since then, taskings have been issued to develop and revise courses and/or modules which support nearly 30 ratings. The taskings have varied from those requiring complete revision of an entire curriculum (e.g., RM rating) to others which focused on the development of instructional material for specific equipments (e.g., the ST rating).

Table 1 lists the ratings for which instructional material development has been completed or is underway. The RM rating is the only rating reported 100 percent complete as of September 1980. Several ratings are nearing completion, and the revised curricula for a number of these have been tested and are being implemented. Considerable difficulty has been encountered with the RM and IC curricula and consequently there have been a number of special taskings to correct deficiencies. Much of the difficulty stems from the fact that these were the first ratings developed. The resources required for these corrective taskings have been attributed to course maintenance and included in the course maintenance data in the resource accounting. A number of ratings listed in table 1 include recent taskings and only minimal work has been accomplished to date on these taskings.

The courses supporting the 28 ratings listed in table 1 which have been scheduled for treatment by the IPDCs represent approximately 7,200 original contact hours as determined from data in the Navy Integrated Training Resources and Administrative System (NITRAS). These courses, when completed, will include less than 2 percent of the total contact hours and 17 percent of the total training days. However, many of the courses included represent recent taskings, and the work underway does not accurately reflect or measure the accomplishment over the first four years of the ISD/IPDC commitment. If only those ratings are included in which the validation phase is reported at least 85 percent complete as of September 1980, then approximately 0.5 percent of all contact hours have been revised which includes less than 4 percent of the total training days. Tasking to date has almost totally involved the "A" courses. Those courses which are substantially complete account for approximately 4 percent of all "A" school contact hours and include approximately 12 percent of the total "A" school training.

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which were submitted at least bi-weekly between the period 1976 and 1980, were also reviewed to isolate those problems which were reported and assumed to impact on the operation of the IPDCs.

Each IPD site reports a detailed breakdown of labor utilization in a CNET developed and maintained man-hour accounting system. These data were collected, summarized, and analyzed to extract information on the utilization of labor.

The expenditures attributed to the IPD effort have been carefully documented since the establishment of the first IPDC at San Diego in July 1976. These expenditures are documented in sufficient detail to identify the resources expended by each tasking and/or course. These detailed cost data were collected for the period July 1976 to September 1980 and are the basis of the cost analysis presented in this study. The cost data compiled for each tasking and course were reconciled with the official budgetary records to insure data integrity.

Each month the situation summaries for each IPDC provide an estimate of the percent complete of each tasking. These estimates were used to determine the equivalent hours. The equivalent hours were then used as a basis for determining the cost of work in progress. Each IPDC was asked to complete a form explaining the characteristics of the courses which have been developed. A summary of the survey results is presented in appendix A. Productivity rates were computed on the basis of equivalent hours completed using data obtained from the above sources.

The man-hour accounting data and cost summaries presented in this report are often drawn from different sources. These aggregate summaries were used to extract information which would enable judgments to be made about current productivity rates and trends, and to relate the potential work effort ahead to what has been accomplished over the first four years of the IPDCs' efforts.

The need to draw data from various sources has led to some reduction in precision of numbers but not in the objective of obtaining useful management information for planning. This study drew extensively from existing data bases and interim status reports and any deficiencies in these data bases and reports will, to some extent, be reflected in the study findings. An effort was made to identify these deficiencies, and the findings were then appropriately caveated.

ORGANIZATION OF THE REPORT

In addition to this introduction, the report contains three sections and two appendices. Section II contains an analysis of the cost and utilization of manpower for the period 1976 to 1980. The analysis focuses on the two major IPDCs at San Diego and Great Lakes and includes a detailed descriptive analysis of manpower utilization trends at the San Diego IPDC. Section III addresses problems dealing with productivity and output of the IPDCs. Section IV contains a summary of the report including resources expended, problems, and recommendations. Appendix A is a summary of cost and productivity data. Appendix B includes detailed labor utilization by ISD functions and pay periods for a selected set of courses which have been developed.

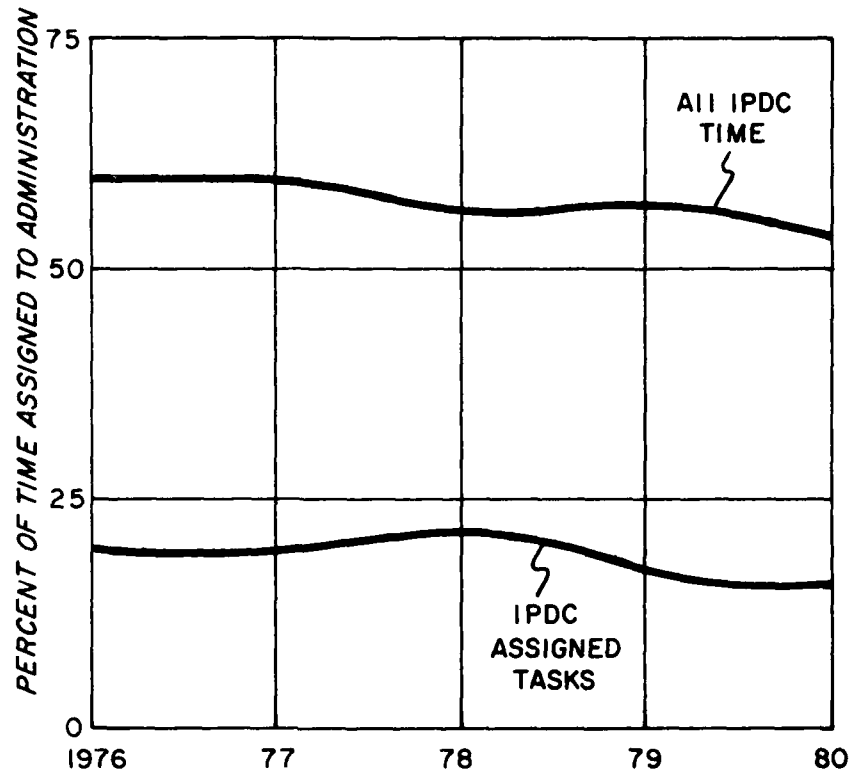


Figure 1. Percent of IPDC Time Assigned to Administration, 1976 to 1980 (San Diego)

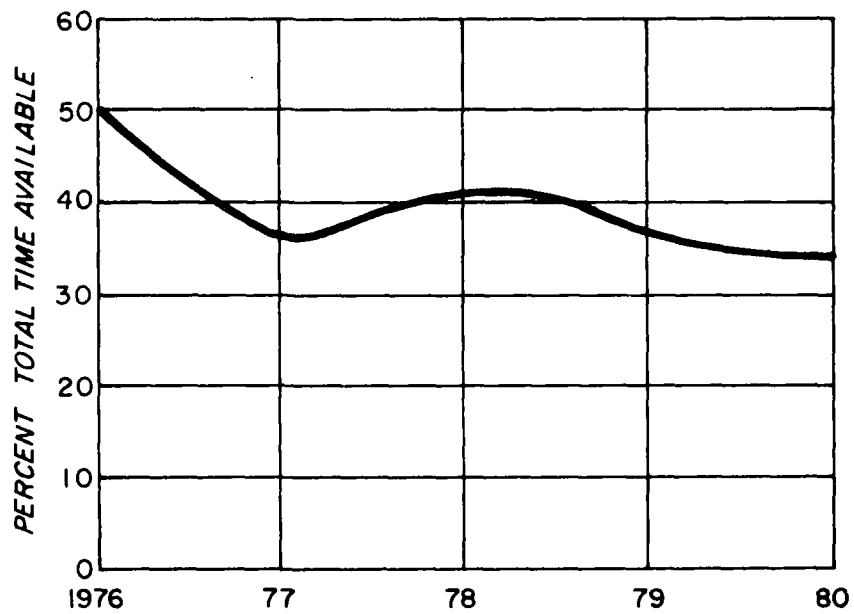


Figure 2. Percent of Total Time Available Which Was Allocated to NonIPDC and Nonidentified Tasks (1976 to 1980)

TABLE 10. MANPOWER UTILIZATION AS DISTRIBUTED BETWEEN ASSIGNED TASKS AND OTHER FUNCTIONS, SAN DIEGO (1976 to 1980)

Category	1976		1977		1978		1979		1980	
	Hours	Percent	Hours	Percent	Hours	Percent	Hours	Percent	Hours	Percent
Non-IPD/No Task	30,779	50	87,154	36	110,749	41	101,135	37	67,520	34
Leave	7,200	12	29,300	12	31,900	12	35,646	13	22,447	11
Assigned Tasks	22,573	38	127,655	52	123,398	46	137,220	50	107,548	55
TOTAL	60,552	100	244,109	100	266,027	100	274,001	100	197,515	100

SECTION III

IPDC PRODUCTIVITY

The rate at which the IPDCs develop instructional materials can be increased by committing more resources to the IPDC and improving the efficiency of the developmental process.

RESOURCES COMMITTED TO THE IPDCs

The Navy must develop instructional material to train personnel in the use and maintenance of new technology and to update and improve existing courses. The essential question is whether the highly structured IPDC is the most efficient way to accomplish the necessary course development and/or revision.

Past justification for the IPDCs has rested on the assumption that an IPDC developed course would be of high quality and would usually reduce training time. It was assumed that expenditures to establish and operate the IPDC would be justified by the cost savings associated with the reduced training time. Therefore, there was little effort, if any, devoted to analyses of alternative strategies for implementing the ISD model. However, as shown in section II, the current rate of course development by the IPDCs will not be adequate to develop, update, and maintain all Navy courses in a timely manner.

Since the rate at which development occurs in the IPDCs depends primarily on the quantity of resources devoted to the ISD effort, it will require a massive investment and expenditure to apply the ISD process to all courses using the present highly structured IPDC organization. Even if the average development time at the IPDCs could be reduced to 100 man-hours per hour of instruction (a 100 percent improvement) with over 500,000 hours of instruction in all NAVEDTRACOM courses, it would require a minimum of six to seven thousand man-years to develop all courses. The labor required for course maintenance would add significantly to manning required.

The benefits of past IPD efforts, in terms of quality and relevancy of instruction and reduction of training time, may well exceed the costs even though it will require a large commitment of resources to completely ISD all Navy courses. For example, although most IPDC personnel would prefer to eliminate the IC rating (because of the high development costs) from any analysis which attempts to determine the returns to the ISD process, the data indicate that the IC course will be reduced by more than 20 percent in length. Assuming no degradation in student performance from using the new course, the reduction in course length will yield substantial benefits in terms of resources saved making it a highly attractive investment. The reduction in student costs would pay for the development costs in four to five years.

Even so, a favorable benefit/cost ratio does not justify the present structure of the IPDCs if the benefits per dollar of expenditure may be further increased by alternative means. For example, restructuring the IPDCs in a way which more fully integrates the local school resources into

the development process may reduce development costs. In addition, benefits could be improved by limiting the IPDC efforts to those courses which have high throughput and to those courses or parts of courses which are determined to be deficient in effectiveness and/or efficiency.

Resources committed to the ISD effort at the IPDC can yield significant returns, but the amount which should be allocated to ISD depends upon the alternative returns from other competing resource demands. Analyses to support those allocation decisions are beyond the scope of this effort. However, once the decision is made to allocate a specified level of funding to the IPD effort then an appropriate management objective is to utilize those funds to maximize the benefits to the training command. This report is intended to support the latter management objective.

MEASURING EFFICIENCY IN THE DEVELOPMENT OF COURSES

Efficiency in production is measured as the rate of output per unit of resources employed. Identification, measurement, and the tracking of resources utilized have been relatively complete and accurate for the Navy IPD effort. However, the identification and measurement of the IPDCs' output is at best a highly subjective undertaking. One measure of efficiency in production frequently employed is the resources used per original course hour revised and/or developed. Much of the criticism of this measure centers on the fact that the scope of the effort among the various tasks was quite different. Consequently, variation in resources utilized (per original course hour) among the various courses would arise from factors other than variation in efficiency. However, the present course length (or average contact hours), an indirect measure, is the only readily available measure for estimating the magnitude of work required for any course scheduled for ISD. Productivity rates derived from these measures provide useful data for management and planning.

The cost and man-hour requirements per original contact hour were computed for courses presently under development at the IPDC. Because of the variation in tasking, course characteristics, quality of existing course material, and a number of other factors, the productivity rates experienced in the development of each course must be heavily caveated in their interpretation. A particular productivity rate only offers evidence of the general magnitude of effort which will be required for future ISD/IPD work, and the resources used for the development of any given rating should not be the sole basis for making judgments about the efficiency of IPDCs in developing that rating.

The development cost per original contact hour which has been computed for the IPDCs efforts to date may, in some instances, tend to understate the costs which would have been experienced with a full developmental effort. This potential underestimate would result from two considerations. First, the costs are averaged over all of the original contact hours and if a significant amount of material from the existing course was adequate or needed only minimal development it would tend to reduce the average cost per original hour. Second, if the IPDC only addressed certain phases of the ISD model then average cost per original contact hour would be underestimated.

The man-hour and cost accounting data provide a record of the utilization of resources committed to the IPD effort since the establishment of the IPDCs. However, no clear and standardized means for identifying the nature and scope of

the tasking of the IPDCs by CNET exists. Tasking letters from CNET to the IPDCs vary from very cryptic, generalized statements to more specific statements detailing the nature of the work to be accomplished. The establishment of a preanalysis baseline data report at the initiation of each task would provide the basis for ascertaining the nature and scope of the development effort. The resources required, present length of course, throughput, student performance scores, average on board and a number of other data items could be included in this baseline report. At the present time many of these data are not readily available and it is difficult to reconstruct the data to use as a basis for evaluating the present IPD effort.

When a tasking is completed, a postdevelopment report could be prepared which would include data on the new course. Many of the data items would be identical to the preanalysis report. Using these data items, one could determine how the course was changed and what resources were committed to effect those changes. One significant difficulty with the present reporting system is that there seems to be no point in the development process where a course can be identified as completed. Each course developed seems to have transitioned into a maintenance mode with no clear demarcation between development and maintenance. Consequently, data on the length of the new course, instructional methods utilized, and other course characteristics remain ambiguous. The values placed on each data element depend to a large extent on when the data are collected. This ambiguity compounds the problem of attempting to determine if the ISD process resulted in a product worth the expenditure. A CNET instruction establishing a pre and postdevelopment report could eliminate a great deal of the problems encountered in analyzing the benefits and costs resulting from the application of the ISD process.

The major deficiency in attempting to evaluate the efficiency of the entire ISD/IPD effort stems from the lack of any baseline data from which one can determine whether students trained using the new course are able to perform at a higher proficiency level and receive more relevant training than those trained using the old course. Tests are developed in the early stages of the ISD process which reflect current training needs and requirements. These tests could be administered to a sample of students trained using the old curriculum and then later to a sample of students using the new curriculum. Differences could be attributed to the change in curriculum resulting from the IPD effort.

Students trained using the old curriculum may not perform well when measured against a new and updated set of training objectives. For this reason this approach has been criticized as an unfair basis for making a judgment as to the adequacy of training received in the existing schools. Such criticism is based on the unwarranted assumption that it is only the present schools performance which is being judged. The appropriate objective is to determine if the students being trained using the present curriculum are able to perform according to present needs. If the students are performing according to present needs then the curriculum should not be targeted as a high priority course for continued instructional systems development. If they are not performing, then for whatever reason, the curriculum and/or school management needs to be revised and updated. Performance measures obtained from such testing would provide a quantitative and objective basis for judging the effectiveness of any subsequent development.

These performance data could then be used for making judgments as to the relative effectiveness of the newly developed course and for making inferences about the desirability of the current ISD/IPDC approach to curriculum development. Effectiveness of the course is defined here to mean the degree to which the students trained using the new course are able to perform as measured against a current and updated set of training objectives. Since the resources will have already been committed to the development, any possible deterioration or improvement in performance using the new course would serve only for guiding and planning future development. Such performance data are necessary for making long-run decisions about the economic feasibility of the entire ISD/IPDC approach to curriculum development.

PRODUCTIVITY ENHANCEMENT

The large number of courses which require revision, the resource constraints, and the rate of development which the Navy has experienced with the present IPDCs make it apparent that some modification in the way the ISD model has been implemented is necessary, if most of those courses needing attention are to be treated in a reasonable length of time. A move away from a philosophical approach of doing development "for the schools" to one in which development is done "with the schools" would substantially resolve many problems presently encountered. When the course development function was removed from the school and placed in the IPDCs, the opportunity for utilizing any schoolhouse resources for course development was greatly diminished.

An IPD/ISD program which is highly integrated with the school would help to minimize the political difficulties encountered when it becomes necessary to update and develop a course. In addition, resources could be used more efficiently if considerably more effort were devoted to a preanalysis of the existing course. Such an analysis would make explicit any unique problems associated with the course/school. It would also aid in isolating those parts of the course which were in need of development and revision as well as isolating those parts which were adequate.

The greatest benefits from resources applied to ISD can be realized if those resources are applied to courses and modules of courses which have the highest throughput and which are in the worst condition as determined from deficiencies in student performance. Those courses for which student performance is adequate should not be high on the priority list for ISD even though the course material may not meet all criteria of the ISD model.

There was an underlying perception among personnel in the centers that the ISD procedures may be too restrictive and the IPDCs need more latitude to alter the procedures to fit the task. Although difficult to identify explicit incidents, there seems to be a predominant orientation toward the process rather than the product. The "block phenomena" permeates almost every discussion about ISD. This "block" orientation aids in understanding the ISD process but appears to be detrimental and restrictive in applying and implementing the process. The objective of the IPD effort should be to produce quality instructional material and not just to follow the ISD model for its own sake. Application of the ISD model should be viewed as a means to an end and not as an end in itself. In the final analysis, the development of quality curricula is as much an art as a science and the ability to recognize and take acceptable shortcuts

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in the application of the ISD process should come with experience. However, with the rapid turnover of personnel, the potential for gaining that corporate experience is severely constrained.

The purpose and use of the ISD model seems to have been placed in perspective for Army schools by a recent communication issued by the Army Training and Doctrine Command (TRADOC). This message states that the interservice procedure for Instructional Systems Development "... is to be used as a guide only. It is not a regulation. Its purpose is to provide to the service schools a general model, one of a number of such models, which describe a set of procedures for the systematic development, implementation, and evaluation of training and training products."¹⁰

If the primary function of the IPDC is to develop instructional material using the ISD process, and if the performance of the center is to be measured in terms of the rate at which instructional material is developed and/or revised and the quality of that material, then the percentage of time devoted to nonIPD and nonidentified tasks must be reduced. The administrative time devoted to direct support of the courses does not seem unreasonable (approximately 20 percent), but the time assigned to the nonIPD and nonidentified tasks is significantly reducing the time available for developing instructional material.

¹⁰TRADOC msg 101000Z Oct 80, subj: Instructional Systems Development (ISD) Procedures.

SECTION IV

SUMMARY OF FINDINGS

The IPDCs were established in 1976 and since their establishment \$31 million, identified as IPD funds, has been expended. A total of \$7.2 million, or 23 percent of total expenditures, has been in support of the EW rating. (This study does not include a detailed analysis of the ISD effort associated with EW courses since the organization of the EW effort is atypical of the way the IPDCs have operated during the first four years.)

During the period 1976 through September 1980, the development for one rating has been reported to be 100 percent complete. However, the instructional material for at least 12 courses and/or ratings is essentially complete and has been either placed in the school or is in the process of being validated and is nearly ready for implementation.

Excluding those courses which are being developed under contract, the IPDCs, as of September 1980, have scheduled approximately 8,000 original contact hours for development. Most of this development was type "A" courses. The 8,000 hours represent less than 2 percent of the total contact hours which presently exist in the CNET controlled courses and approximately 10 percent of the total of type "A" courses. Because a number of the ratings developed included high throughput courses, the proportion of the total Navy training which will use this new material is considerably higher than the above percentages would imply. Including work in progress (for those ratings which were sufficiently complete to make estimates), it was estimated that 3,200 equivalent hours of original course material has been revised and/or developed. These nearly completed courses represent approximately 0.5 percent of all contact hours and approximately 4 percent of type "A" contact hours. Generally, these were high throughput courses and ones in need of attention. The benefits are somewhat greater than the latter percentages would imply.

During this period, \$21 million (excluding contracted courses) was expended in support of the IPDCs, of which an estimated \$3 million was devoted to supporting existing school programs and not used in direct support for developing the instructional material for courses/ratings assigned to the IPDCs. The average cost of revising the original material for the efforts which were completed or nearing completion was \$4,970 per original hour. The average man-hour requirement to date has been 308 man-hours per original course hour (varying from a low of 111 to a high of 744). The IPDCs did not do all phases of the ISD process for all courses assigned for development. Consequently, the man-hours may tend to be slightly understated when interpreted in terms of labor requirements for a full ISD effort. The distribution of labor among the phases of the ISD process for the ratings nearing completion was as follows: analysis, 13 percent; design and development, 35 percent; other, 15 percent; and indirect support, 37 percent. The other category includes administrative overhead support which could be directly attributed to the course under development.

Excluding the RM and IC ratings, since they were the first ratings developed, there is no evidence to indicate that the rate of productivity has shown any consistent improvement. The resources utilized per hour of material developed/

revised does not appear to be decreasing; on that basis alone one might infer that there has been no improvement in productivity. However, the quality of the instructional material and, ultimately, student performance is as important to productivity measurement as the rate of resource utilization. The paucity of data reflecting changes in instructional material quality and student performance resulting from the ISD process makes judgments about productivity highly tenuous. Sufficient data are not available to reach any definite conclusions about the changes in productivity, aside from the fact that a great deal of disagreement exists on just how one should measure the productivity of the centers.

The one metric available to place in perspective the potential magnitude of developmental work to be done is the number of existing contact hours presently under the cognizance of NAVEDTRACOM. Using original contact hours as a basis of judgment, and considering (1) the rate at which development is being accomplished, (2) the cost of developing, and (3) the amount accomplished to date, one must conclude that the present highly structured IPDCs simply do not provide a realistic capability for developing and maintaining all "A," "C," and "F" CNET-controlled courses.

One basis on which the highly structured ISD/IPDC program was justified was that it would reduce the training time in the courses while at least maintaining the same level of training effectiveness. Since so few courses have been completely developed, it is difficult to determine if the average projected reduction in course length of 10 to 15 percent is going to be realized in the long run. An estimate of the final course lengths for courses presently under revision would indicate that the reduction in hours will be approximately 10 percent. However, these estimates are so tenuous and experience so limited that no reliable conclusions can be made from the experience with the courses presently being developed at the IPDCs.

The assumption that training effectiveness will at least be maintained can be neither objectively supported nor rejected. There simply is no objective data base being developed and maintained from which to make decisions about the relative effectiveness of the newly developed course versus the old course. There is an implicit assumption that any course which has been developed using the ISD process will result in more effective and relevant training. However, except for a few isolated efforts, there is no widespread effort to pre and posttest the students' performance using current and updated training objectives to establish the validity of this assumption.

There is some potential for improving the rate at which curriculum can be developed by more rigid controls on the utilization of manpower at the IPDCs. This would essentially require the IPDCs to commit their manpower only to the IPD assigned tasks. Such constraints on assignment would address the problem of utilization but not the problem of efficiency. It is unclear as to the nature of the unidentified and nonIPD tasks. To the extent that such tasks do in fact play a vital support role to the IPDC, then the potential for improvement in the rate of production would be diminished.

PROBLEM AREAS

Monthly situation summaries have been submitted to CNET by each of the IPDCs since the centers were established. These summaries document problem

areas encountered by the centers. The problems presented in the situation summaries are summarized in table 11. By far, the most difficult problem encountered since the establishment of the IPDCs has been the availability of subject-matter expert (SME) support although there has been a significant decline in the number of incidents reported. There was, however, indications from interviews with IPDC personnel that SME availability continues to be a severe problem and the decline in incidents reported stems from the fact that the reporting of the SME difficulties did not stimulate any relief from the problem. The futility of reporting led to a reduction in the number of incidents reported. Most problems have shown a significant decline in incidents reported since 1977, except personnel acquisition and retention. The acquisition and retention of skilled personnel have been rather severe problems since the establishment of the IPDCs. The largest IPDC, San Diego, has experienced a great deal of personnel turnover at the midmanagement level. A review of personnel actions, as reported in the situation summaries, indicated that 70 individuals were hired at the GS-9 to GS-13 level during July 1976 to September 1980. During that period there were 51 resignations in that same group. The average tenure for those resigning (as computed using those individuals for which a hiring and resignation date were available) was approximately 20 months. The total civilian strength during this period (including all GS grades) varied within an approximate range of 85 to 95 individuals. Many individuals who left the organization were highly skilled technologists, and turnover of those personnel adversely affected the productivity of the center. The high turnover was attributed in a large measure to (1) the fact that higher paying jobs were available to those individuals once they became experienced in the ISD process and (2) the high cost of living in the San Diego area.

The following represents a synthesis of the problem areas identified during interviews with personnel ranging from the commanding officer to working personnel at the IPDCs.

- . There was a great deal of criticism of the lack of well defined interfaces among CNET, CNTECHTRA, the schools, and the IPDCs. The role of the CNET IPD management does not appear to be clearly perceived at the IPDCs. Difficulties which occur between the IPDCs and schools when the ISD process is undertaken are often perceived as a result of insufficient ground work at the higher command.
- . Interfaces which develop among the participants in the ISD process are too often of an adversary relationship. This tends to reduce significantly the efficiency and effectiveness of the IPDC team in its major function as a curriculum developer. More explicit policy defining the interfaces, responsibility, and accountability, and strict enforcement of that policy, would tend to reduce the ambiguity facing the IPDCs.
- . The IPDCs personnel have expressed considerable concern about the number and frequency of nonIPD related tasks and peripheral duties assigned to the centers. This concern is substantiated by the inordinate amount of time allocated to nonIPD and overhead functions in the manpower accounting data.

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TABLE 11. NUMBER OF INCIDENTS REPORTED FOR SELECTED PROBLEM AREAS (1977 to 1980)

Problem Area	1977	1978	1979	1980*
Inadequate SME Support	24	51	11	2
Acquisition of Course Equipment		8	11	6
Validation	10	11	7	6
Command Communication Problems	20	13	8	4
Personnel Acquisition, Retention	6	13	3	13
Task Modifications and Revisions	7	5	2	0
IPDC Support: Facilities & Equipment	4	6	1	0
TOTAL	71	107	43	31

* For 9 months

The future productivity of the IPDCs will be diminished significantly if course maintenance is retained as an IPDC responsibility. An insufficient number of courses have been completed to make any quantitative judgments about the future requirements for maintenance. Estimates indicate that maintenance may take, on a permanent annual basis, 15 to 20 percent of the total resources used in the development of a course. Thus, it becomes readily apparent that future productivity of the IPDCs will quickly decline as they become encumbered with maintenance tasks; their ability to undertake new development will be severely limited and ultimately virtually eliminated.

The compatibility of the POM and budget cycle with the requirements of the IPDCs was severely criticized. The POM cycle forces the requirements for training equipment and aids to be identified and funding requests to be submitted long before the developers have established the type of equipment needed. This tends to bias the criteria for selection of instructional methods. It also sets unnecessary and unwarranted constraints on the options available to the curriculum developer and has contributed to untimely deliveries of training equipment. A more appropriate means for maintaining the necessary flexibility in the selection of instructional methods by the developer would be to provide program or block funding to the IPDCs for acquisition of training aids and equipment. Such funding would provide managers and developers the flexibility to direct resources to those courses where the need is determined as the design and development of the course(s) unfolds.

The IPDC personnel were concerned with the ability of the military personnel assigned to the center to contribute to the ISD process. Much of this concern arose from the fact that the military personnel selected for assignment to the IPDCs were often relatively inexperienced in their ratings and often below the rank authorized.

The perceived inability of the military personnel to contribute significantly to the ISD process could be attributed, in part, to their lack of experience and also in part to the lack of an effective ISD training program for newly assigned military personnel. There was also some indication that a few military SMEs were frequently detailed to the IPDCs during periods when they would have normally been off duty. Such personnel management does not contribute to a highly motivated individual.

The military personnel are intended to contribute most to the analysis phase, especially the task analysis effort which provides the basis for the training objectives. If the analysis effort is reduced at the IPDCs, as initiatives currently underway would indicate, then the need for military personnel assigned to the IPDCs, would be further reduced unless utilization patterns in those personnel are changed. Evidence indicates that there is a change underway in how the military are being utilized. For example, at the San Diego site approximately one-third of the military time is now assigned to development functions, and this has shown a steady increase since 1976. In 1980 less than 10 percent of the military time was assigned to analysis. (See table B-8, appendix B.)

RECOMMENDATIONS

Actions which should be considered for improving productivity rates and management of the centers are outlined below.

- . Policies and programs should be developed which will insure the maintenance of a more stable work force at the IPDCs.
- . A more thorough preanalysis of existing course material should be done for each course selected for development with the objective of selecting and targeting for development only those parts of the course which are deficient.
- . Policy statements should be developed which make explicit the approval requirements, school interfaces, and division of responsibilities between the IPDCs and CNET management.
- . Procedures should be developed for determining and measuring the changes in training relevance and effectiveness which any ISD effort has effected. A pre and postISD testing of students, using a test reflecting current training objectives, would aid in isolating those parts or modules of courses which are deficient. Equally important, the results would provide an objective basis for assessing, for planning purposes, whether student performance was sufficiently improved to warrant the IPD expenditure.
- . Improvements should be made in the current resource tracking system with the objective of simplifying and providing more relevant management information.
- . A standardized CNET course/curriculum status report should be submitted prior to the start of an ISD task and a similar final report should be submitted at the conclusion of each tasking. These reports would document the resources expended, curriculum materials developed, pre and posttest results, course characteristics, results of the pilot testing and other relevant data.
- . An organizational structure should be developed which is sufficiently flexible to provide technical support to any ISD team made up of IPDC personnel, school personnel or any combination of both. The structure of the team would depend on resources available at both the IPDC and school, potential payoff from the course development, and criticality of the course.
- . Block or program funding should be provided for the acquisition of training equipment and materials required to support the courses developed/revised at the IPDCs.

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TABLE 0-2. DISTRIBUTION OF PERSONS IN THE PERIOD (1976 to 1980) FOR THE DEVELOPMENT OF THE IC RATING (continued)

PERIOD	ADMN	ANAL	DSGN	DVLP	MDIA	EVAL	TRNG	TOTAL	ADMN	ANAL	DSGN	DVLP	MDIA	EVAL	TRNG	TOTAL
71	632	9	98	1402	210	29	3	2383	26	0	4	58	8	1	0	
72	354	38	128	1228	522	12	1	2283	15	1	5	53	22	0	0	
73	193	4	116	1154	305			1772	10	0	6	65	17	0	0	
74	276		52	1043	407			1728	13		3	80	23			
75	273		28	1047	275			1623	15		1	64	16			
76	230	3	110	948	137		40	1868	15	0	7	64	9			
77	156		118	911	246	4		1835	10		8	61	17			
78	227		90	999	219		2	1337	14		2	64	14		0	
79	127	79	50	500	168			745	17		6	67	19		0	
80	80		99	664	143	13		1045	12		9	63	13		1	
81	295		69	774	158	38		1334	22		5	58	11		2	
82	284		164	861	155	48		1512	18		10	56	10		3	
83	134	72	144	903	106	10		1369	9	5	10	65	7		0	
84	181		163	983	389	32		1748	14		9	56	22		1	
85	175		47	750	213	16	8	1209	10		3	62	17		0	
86	101		67	783	57	17		1025	9		6	76	5		0	
87	103		94	783	29	8		1017	10		9	76	2		0	
88	160		42	780	77	10		1069	14		3	72	7		0	
89	168		58	584	299	4		1113	15		5	52	26		0	
90	116		62	470	72	3		723	16		8	65	9		0	
91	278		32	464	117	5		836	26		3	55	13		0	
92	217		26	618	266	9		1196	23		2	51	22		0	
93	190		2	627	184	4		1007	18		0	62	18		0	
94	174		8	879	135			1196	14		0	73	11		0	
95	163		15	606	91	3		878	18		1	69	10		0	
96	190		46	435	82	4		737	25		6	59	18		0	
97	145		15	357	90	28		635	22		2	56	14		4	
98	104		14	345	124	11		598	17		2	52	20		1	
99	147		33	337	136	17		637	23		2	52	21		2	
100	116		63	346	155	8		688	16		9	50	22		1	
101	95	17	57	347	154	50		703	13	2	8	49	21		7	
102	52		69	216	72	149		575	19		12	37	12		25	
103	52		34	188	44	108		426	12		7	44	10		34	
104	44		30	148	96	165		370	9		6	30	19		25	
105	10		4	145	64	108		227	4		1	19	28		47	
106	44		23	192	106	108		473	9		4	40	22		22	
107	51		45	229	155	144		624	8		7	36	24		23	
108	38		32	217	127	140		554	6		5	39	22		25	
109	28		4	201	105	122		460	6		0	43	22		26	
110	49		308	35	97	97	7	496	9		10	62	7		19	
111	27		296	72	89	89	1	485	5		5	61	14		18	
112	126		246	112	106	134		553	22		3	44	13		19	
113	81		17	178	112	86		522	15		34	21	21		25	
114	94		6	168	240	77		594	15		1	28	40		14	
115	111		8	170	138	77		502	22		1	33	27		15	
116	45		6	224	106	53		436	10		1	51	24		12	
117	38		6	197	206	16		463	8		1	42	44		3	
118	16		10	201	234	17		478	3		2	42	48		26	
119	152		38	231	148	148		569	26		6	40	26		4	
120	157		32	335	208	21		732	21		7	45	28		28	
121	94		48	294	170	29		606	15		7	48	28		28	
122	21		29	190	29	17		269	7		10	70	10		10	
123	30		34	170	67	9		301	9		11	56	22		11	
124	75		61	194	35	20		365	20		16	53	35		9	
125	71		67	152		24		290	24		23	52			5	
TTL	23632	26913	12020	57743	14308	2979	633	138228	17	19	8	41	10	2	0	

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TABLE B-1. DISTRIBUTION OF LABOR AMONG THE 100 FUNDATIONS FOR EACH YEAR PERIOD (1976 to 1980) FOR THE DEVELOPMENT OF THE RM RATING (continued)

PERIOD	ADMN	ANAL	USGN	DVLP	MDIA	EVAL	TRNG	TOTAL	ADMN	ANAL	USGN	DVLP	MDIA	EVAL	TRNG
71	226	66	55	89	19	9		455	49	14	12	17	4	1	
72	283	61	61	26	12	96		481	33	0	12	5	2	19	
73	190	43	55	38	47	128	9	560	58	7	9	6	17	22	1
74	175	61	73	62	80	38		489	33	12	14	12	16	17	
75	330	33	83	26	92	102		646	51	5	12	14	11	15	
76	207	207	73	69	48	97		494	41	4	14	13	9	19	
77	158	19	20	79	132	38	24	470	33	4	4	4	28	8	5
78	189	91	23	79	63	89	24	558	33	16	4	14	11	15	4
79	82	4	158	34	45	66		389	21	1	40	8	11	16	
80	98	92	148	29	49	66		423	23	21	34	6	11	1	
81	90	17	262	93	52	5	73	592	15	2	44	15	8	0	12
82	213	198	115	111	11	2	32	571	37		34	20	1	0	5
83	135	233	104	104	4			472	28		49	22	0		
84	207	108	265	265	34	10		584	35		18	45	0		
85	246	226	299	299	67	54		815	30		27	36	4		
86	113	72	381	381	67	88		687	16		10	55	9		
87	189		324	324	9	98		620	30		52	9	1		
88	129	4	448	448	16	88		717	17	0	5	62	2		
89	161		394	394	20	88		588	10		3	67	3		
90	165		361	361	98	33		666	24		1	54	14		
91	88		321	321	78	59		582	15		6	55	13		
92	61		206	206	73	85		476	12		10	43	15		
93	81	167	70	38	5	35		396	20	42	17	9	1		
94	77	120	71	160	27	27		455	16	26	15	35	5		
95	128	62	65	275	44	47		574	22	21	11	47	7		
96	119	103	49	152	49	47		470	25	21	10	32	10		
97	87	164	39	182	13	93		465	18	13	8	39	20		
98	133	112	97	115	23	23		460	24	24	21	25	5		
99	123	95	67	158	29	29		472	26	20	14	33	6		
100	189	82	19	143	54	44		431	20	19	4	33	12		
101	104	92	24	232	4	38		494	21	18	4	46	0		
102	113	109	31	149	4	53		459	24	23	6	55	0		
103	29		16	193	3	108		349	8	9	6	6	5		
104	224	78	50	385	47	44		828	27	9	6	49	6		
105	156		226	226	28	48		458	34	10	4	46	5		
106	182	72	28	234	31	77		671	29	10	5	34	4		
107	191	72	35	263	19	77		657	29	10	4	40	2		
108	172	23	52	181	19	58		557	29	10	37	37	2		
109	176	65	26	124	1	37		486	35	14	19	37	0		
110	156		85	223	12	11		329	23	19	7	37	0		
111	144		79	200	17	11		440	32	17	17	45	2		
112	255		60	283	36	8		642	39	32	17	45	3		
113	85		60	340	33	51	2	569	14	9	9	44	5		
114	159		78	339	30	12		620	25	12	12	54	4		0
115	158		110	465	45	36		814	19	13	13	57	5		
116	195		62	274	62	25		618	31	4	10	44	10		
117	94	38	109	156	418	89		815	11	4	13	19	51		
118	63		69	213	352	89		786	8		8	8	27		
119	54		30	80	219	150		533	10		5	15	44		
120	88		8	112	30	166		404	21	9	1	27	41		
121	60	38	24	116	46	121	12	405	14	3	5	28	11		2
122	80	20	25	160	25	198		520	15	11	4	30	4		
123	112	88	25	369	48	122		764	14	9	3	48	6		
124	115	64	12	447	11	7		656	17	9	1	68	1		
125	214		1	502	34	6		757	28	7	0	66	4		
TTL	29028	9225	11255	36466	20978	7823	1381	116156	24	7	9	31	18	6	1

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TABLE B-1. DISTRIBUTION OF LABOR AMONG THE ISD FUNCTIONS FOR EACH PAY PERIOD (1976 to 1980) FOR THE DEVELOPMENT OF THE RM RATING

PM	2 WEEK PERIOD	MAN-HOURS BY FUNCTION					MAN-HOUR TOTAL	% MAN-HOURS BY FUNCTION								
		ADMN	ANAL	DSGN	DVLP	MDIA		EVAL	TRNG	ADMN	ANAL	DSGN	DVLP	MDIA	EVAL	TRNG
	12	30					30	100								
	13	71					71	100								
	14	97					97	100								
	15	177	204				381	46	53							1
	16	131	760				909	14	83							5
	17	5	672				715	0	93							
	18	65	894	45			1004	6	89	4						
	19	112	607	127	24		870	12	69	14						
	20	114	288	405	45		858	13	33	47						
	21	206	417	351	144		1134	18	36	30						1
	22	156	333	268	201		961	16	34	27						
	23	189	430	213	307	43	1182	15	39	18						1
	24	129	336	366	479	5	1339	9	25	27						1
	25	169	207	194	386	3	959	17	21	20						2
	26	116	188	165	598	3	1141	10	16	14						4
	27	36	52	69	264	67	504	7	10	13						13
	28	149	134	189	548	14	1074	13	12	17						3
	29	192	109	257	679	299	1562	12	16	16						1
	30	383	116	299	798	418	2033	18	5	14						19
	31	447	115	157	842	307	1929	23	5	8						20
	32	637	105	189	823	484	2282	27	4	8						15
	33	656	78	196	833	483	2332	29	3	35						3
	34	689	61	191	811	624	2388	28	2	7						1
	35	722	39	171	1030	587	2593	27	1	6						0
	36	752	39	108	1040	503	2593	28	0	4						0
	37	748	60	102	987	698	2663	28	2	3						1
	38	846	24	112	924	821	2591	24	0	4						2
	39	843	39	166	1207	1045	3390	24	1	4						2
	40	591	17	127	1043	1795	3675	16	0	3						2
	41	516	13	166	1122	1264	3081	16	0	5						2
	42	754	158	1040	1794	154	3802	19	0	4						1
	43	779	149	999	1690	1690	3818	20	0	27						3
	44	644	88	963	667	419	2447	26	3	3						3
	45	611	193	491	419	8	1792	34	24	10						0
	46	230	361	288	405	54	1469	24	15	19						3
	47	317	93	365	152	140	1497	34	8	15						3
	48	308	317	332	118	178	1108	27	11	8						2
	49	223	273	317	132	280	1104	20	7	7						1
	50	220	82	359	175	111	947	23	23	8						25
	51	270	82	359	175	111	947	28	11	11						12
	52	318	116	329	184	119	1086	29	18	10						12
	53	205	178	165	144	128	724	28	10	22						19
	54	202	126	140	140	128	724	28	14	15						6
	55	322	158	184	53	262	886	29	3	6						29
	56	325	161	184	54	265	929	30	15	17						5
	57	327	161	184	54	265	929	30	15	17						22
	58	484	187	184	104	377	1172	42	8	16						32
	59	335	114	199	56	361	1105	30	10	7						18
	60	359	114	274	58	169	983	37	11	10						37
	61	372	114	319	105	146	1056	35	10	11						5
	62	403	93	441	361	189	1387	29	31	10						13
	63	330	88	578	340	106	1442	22	6	6						9
	64	460	80	558	262	123	1483	31	5	37						7
	65	249	152	120	255	184	1269	22	8	40						13
	66	386	152	120	146	155	1156	33	13	10						24
	67	502	128	64	86	26	912	55	14	7						17
	68	501	120	24	136	20	873	57	13	2						9
	69	339	188	8	143	67	841	46	22	15						8
	70	433	152	72	187	35	797	54	19	9						5

APPENDIX B

MANPOWER UTILIZATION

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TABLE A-6. INSTRUCTIONAL SYSTEMS DEVELOPMENT EXPENDITURES
BY RATING FOR THE PERIOD 1976 TO SEPTEMBER 1980
(\$1,000)

	Military Labor	Civilian Labor	Material	Contract	Other	Overhead	Total
RM	\$ 48.4	\$ 838.0	\$ 65.0	\$ 157.9	\$101.7	\$ 870.7	\$2,081.7
DS	38.4	161.9	1.7	0.1	3.6	151.2	356.9
IC	212.3	1,388.8	85.4	267.9	86.8	1,156.1	3,197.3
ST	126.7	536.1	22.7	2.0	14.6	408.9	1,111.0
ET	189.8	560.0	244.4	458.2	83.0	609.5	2,144.9
HT	62.7	258.1	16.1	0.8	33.5	209.9	581.1
EM	19.1	273.3	3.6	870.3	1.9	355.2	1,523.4
FA	37.2	431.5	97.3	126.9	69.3	781.5	1,543.7
EO	95.7	101.8	0.1	0.0	0.1	138.1	335.8
CM	19.5	13.1	0.1	0.0	0.0	28.5	61.2
UT	24.6	35.2	0.0	0.0	0.0	43.2	103.0
EA	8.9	10.4	0.1	0.0	0.1	15.0	34.5
BU	10.7	4.6	0.0	0.0	0.0	13.3	28.6
SW	7.2	4.0	0.0	0.0	0.0	8.9	20.1
CE	5.6	2.6	0.0	0.0	0.0	6.5	14.7
DP	180.8	315.0	35.2	6.2	6.1	353.7	897.0
SA	55.3	325.4	124.8	2.7	89.1	234.0	831.3
AA	47.2	340.7	83.5	0.0	25.0	229.2	725.6
FT	4.2	41.4	14.2	0.0	0.0	21.5	81.3
BE&E	0	126.2	34.0	0.0	50.0	56.4	266.6
EW	666.9	842.6	373.3	4,010.6	24.5	1,257.1	7,175.0
CT	64.8	34.2	19.7	1,902.9	8.9	91.4	2,121.9
IT	91.4	181.3	0.1	700.2	26.1	186.0	1,185.9
RT	11.1	22.9	0.0	0.0	0.0	20.1	54.1
MM	0.0	2.7	0.0	0.0	0.0	1.2	3.9
BT	0.0	3.6	0.0	0.0	0.0	1.6	5.2
PE	22.1	65.7	0.0	0.0	0.0	45.2	133.0
GM	6.4	4.6	0.0	0.0	0.0	6.6	17.6
RM (Maint)	32.6	307.5	9.2	1.9	65.8	218.6	635.6
Existing Programs	0.0	144.1	1,658.6	542.7	619.4	0.0	2,964.8
Other	38.9	368.9	60.5	62.2	97.5	289.1	917.1
TOTAL	2,128.5	7,746.2	2,949.6	9,113.5	1,407.0	7,809.0	31,153.8

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TABLE A-5. SUMMARY PERFORMANCE DATA FOR IPDCs THROUGH SEPTEMBER 1980

	MAN-HOURS			Total Expenditures (\$1,000)	Original Contact Hours	Projected Revised Contact Hours	Percent Change in Contact Hours	Equivalent Hrs Complete		Total Labor Costs
	S.D.	G.L.	S.D.					G.L.	Original	
RM	84,831		43,504	\$2,082	396	396	0	396	396	886
DS	18,582		9,529	357	931	NC*	-	-	-	200
IC	139,411		71,495	3,197	295	252	-14	284	242	1,601
ST	59,156		30,337	1,111	300	270	-10	297	270	663
ET	24,572	47,309	12,601	2,145	848	840	-10	772	765	750
HT	31,499		16,154	581	426	385	-10	371	281	321
EM	240		123	1,523	213	322	+51	70	149	292
FA		28,564	24,296	1,544	85	140	+60	85	140	469
FO	16,814		8,623	336	240	NC	-	230	230	198
CM	3,394		1,741	61	355	NC	-	ID	ID	33
UT	6,240		3,200	103	298	NC	-	ID	ID	60
EA	1,912		981	35	312	NC	-	ID	ID	19
BU	1,797		922	29	251	NC	-	ID	ID	15
SM	1,307		670	20	365	NC	-	ID	ID	11
CE	1,153		591	15	217	NC	-	ID	ID	8
DP	49,853		25,566	897	312	280	-10	258	258	496
SA	32,100		16,462	831	85	140	+60	81	134	381
AA		35,080		726	85	140	+60	81	133	388
AA		3,944		81	455	NC	-	-	-	46
FT	252		129	267	MEW	91	-	90	90	126
BE&E	1,895		972	7,175	5,960	NC	-	ID	ID	1,510
EW		14,934		2,122	284	NC	-	ID	ID	99
CT				1,186	449	350	-22	ID	ID	273
IT				54	NC	NC	-	ID	ID	34
RT	3,958		2,030	5,988	190	NC	-	ID	ID	3
PH		214		396	4	NC	-	ID	ID	3
BT	25		13	497	5	NC	-	ID	ID	4
PE		8,102		133	125	NC	-	ID	ID	88
GM		1,407		18	NC	NC	-	ID	ID	11
SUBTOTAL	478,991	165,412	245,643	26,638	14,407					9,877
EXIST				2,965						144
RM (Maint)	31,325		16,065	636						340
FA (Maint)		13,934								
OTHER	14,121	0	7,243	917						408
NONIPD	164,472	23,559	84,347							
SUBTOTAL	209,918	37,493	107,655	4,518						
TOTAL	688,909	202,905	353,298	31,156	14,407					

* NC = Not complete
 ** ID = Insufficient data

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TABLE A-4. RELATIONSHIP OF COURSES AND CONTACT HOURS TO THE PERCENT OF TRAINING DAYS FOR TYPE "F" NAVEDTRACOM COURSES

Number of Courses	Training Days (1,000)	Percent of Total Training Days	Cumulative Contact Hrs.	Percent of Total Hrs.
2	86	5	14	0.03
4	174	10	40	0.07
9	347	20	172	0.33
14	521	30	244	0.47
24	695	40	572	1.10
53	868	50	1,355	2.61
101	1,042	60	2,959	5.70
161	1,216	70	5,674	10.93
267	1,389	80	10,350	19.94
465	1,563	90	19,540	37.65
1,146	1,737	100	51,900	100.00

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TABLE A-2. RELATIONSHIP OF COURSES AND CONTACT HOURS TO THE PERCENT OF TOTAL TRAINING DAYS FOR TYPE "A" NAVEDTRACOM COURSES

Number of Courses	Training Days (1,000)	Percent of Total Training Days	Cumulative Contact Hrs.	Percent of Total Hrs.
1	470	5	139	0.18
4	942	10	388	0.50
8	1,885	20	1,307	1.70
10	2,827	30	1,307	1.70
18	3,770	40	2,833	3.68
29	4,712	50	5,474	7.10
43	5,655	60	9,509	12.34
54	6,597	70	14,628	18.98
70	7,540	80	21,092	27.36
104	8,482	90	33,494	43.45
233	9,425	100	77,087	100.00

TABLE A-3. RELATIONSHIP OF COURSES AND CONTACT HOURS TO THE PERCENT OF TOTAL TRAINING DAYS FOR TYPE "C" NAVEDTRACOM COURSES

Number of Courses	Training Days (1,000)	Percent of Total Training Days	Cumulative Contact Hrs.	Percent of Total Hrs.
4	242	5	372	0.09
7	485	10	668	0.16
20	969	20	2,030	0.50
41	1,454	30	7,646	1.88
78	1,939	40	15,967	3.93
125	2,424	50	27,950	6.88
220	2,908	60	47,760	11.76
308	3,393	70	73,990	18.22
458	3,878	80	109,301	26.92
636	4,362	90	161,731	39.83
1,510	4,847	100	406,095	100.00

TABLE A-1. SUMMARY OF OUTPUT DATA FOR SELECTED COURSES AND/OR COURSE MODULES

Category	Course/Module											
	BE&E	FA	AA	DP	DF	ET	IC	RM	SA	ST-23	ST-26	ST-53
Instruction Hours												
New Development	111	54	104	123	60	840	137	267	108	115	124	124
Revised Development	-	12	36	96	-	0	37	90	-	-	-	-
Validation Only	-	-	-	16	-	0	-	48	7	-	-	-
TOTAL	111	66	140	235	-	840	174	405	115	115	124	124
Type Material (Hours)												
Audio-Visual	1	4.75	2.5	28	-	*	5	11	10	11	0.1	-
Tests	10	15	-	-	12	*	-	45	-	9	20	20
Labs	60	26	-	12	-	*	25	250	49	59	68	68
Other	-	30	-	144	-	*	-	-	-	-	-	-
Type Delivery												
Group-Paced** (Percent)	0	100	100	100	50	100	0	0	100	60	60	60
Self-Paced** (Percent)	100	0	0	0	50	0	100	100	0	40	40	40
Average Student Completion Time (Hours)	100	130	140	284	30	140	228	363	120	96	*	112

* Missing Data

** Estimated

APPENDIX A

SUMMARY COST AND PRODUCTIVITY DATA

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TABLE B-3. DISTRIBUTION OF LABOR AMONG THE ISD FUNCTIONS FOR EACH PAY PERIOD (1976 to 1980) FOR THE DEVELOPMENT OF THE ST RATING (continued)

PERIOD	ADMN	ANAL	DSGN	DVLP	MDIA	EVAL	TRNG	TOTAL	ADMN	ANAL	DSGN	DVLP	MDIA	EVAL	TRNG
71	25	318	3	12				346	7	91	0	2			
72	29	410	13					464	6	88	2				
73	27	413	7					447	6	92	1				
74	84	432					13	529	15	81					2
75	134	407		16	1		59	617	21	65	2	2	0		9
76	185	546		9	2		1	743	24	73	1	0	0		0
77	54	203	313	1	23			594	9	34	0	0	3		0
78	57	117	564				2	740	7	15	52				0
79	16	38	237					291	5	13	81				0
80	52		686				76	738	7	92	92				9
81	71	30	543	8			828	828	8	3	77	0			0
82	145	22	587	83			843	843	17	29	69	5			0
83	102	217	401	44	23		740	740	10	29	54	15			0
84	102	121	487	132		38	867	867	11	13	56	15	2	4	0
85	72	6	532	86	36	18	770	770	9	0	22	64	5	1	2
86	57	15	208	600	47	12	930	930	10	1	9	65	1	1	0
87	101	106	91	524	98	34	988	988	18	11	11	41	35	2	0
88	88	121	61	667	429	22	1270	1270	12	66	6	66	24	4	0
89	142		1	584	250	57	1028	1028	13	44	3	0	33	11	0
90	183		40	496	367	12	1111	1111	11	11	0	61	11	11	0
91	121	89	3	489	89	93	795	795	15		0	0	11	11	0
92	218	4	4	296	87	78	686	686	31	78	0	43	12	12	0
93	77	2	2	91	48	433	651	651	11	7	0	13	7	66	0
94	62	11		40	2	412	527	527	11	7	0	7	0	47	0
95	106	88	94	20	77	266	557	557	19	15	22	3	13	47	2
96	61	10		86	29	125	415	415	14	2	22	20	6	30	0
97	340	386		233	74	13	1016	1016	33	37	48	17	8	4	0
98	203	406		153	74	13	854	854	23	47	30	17	4	1	0
99	122	135	250	78	25	5	520	520	26	17	30	15	17	0	0
100	209	135	238	162	135		779	779	21	13	40	15	17	17	0
101	156	94	294	112	64		720	720	21	13	30	15	17	17	0
102	273	24	229	235	22		783	783	34	3	40	15	17	17	0
103	155	29	203	348	20		755	755	20	3	29	30	2	2	0
104	115	23	136	206	6		486	486	23	4	26	46	2	2	0
105	211	101	112	392	18		834	834	25	12	27	42	1	1	0
106	207	59	124	540	41		971	971	21	6	13	47	2	2	0
107	171	16	86	449	119	4	845	845	20	1	10	55	4	4	0
108	201	2	39	539	33		814	814	24	0	4	66	4	4	0
109	276		38	765	156		1205	1205	22	0	3	63	10	10	0
110	252	4	12	848	137		1253	1253	22	0	0	67	10	10	0
111	233	120	21	755	112	4	1125	1125	20	13	1	67	9	9	0
112	181	144	3	404	166	1	875	875	30	13	0	46	18	18	0
113	344	144	7	408	124	17	1044	1044	32	13	0	39	11	11	0
114	221	95	17	487	203	8	1031	1031	21	9	1	47	19	19	0
115	155	11	23	449	278	22	938	938	16	1	2	47	29	29	0
116	181	81	204	457	233	17	1173	1173	15	6	17	38	19	19	0
117	247	160	159	404	91	113	1181	1181	20	13	13	34	17	17	0
118	178	207	85	378	26	6	880	880	20	23	9	34	2	2	0
119	201	431	201	459	255	5	1331	1331	15	32	12	34	17	17	0
120	164	331	130	317	128	5	1075	1075	15	30	12	29	11	11	0
121	158	292	187	224	15	103	979	979	16	29	19	22	11	11	0
122	200	328	153	149	53	80	963	963	20	34	15	15	5	5	8
123	226	532	187	113	42		1100	1100	20	48	17	10	3	3	0
124	254	653	233	172	54		1272	1272	19	51	18	5	4	4	0
TTL	9848	19048	8301	14971	4345	2415	59156	59156	16	32	14	25	7	4	0

TABLE B-4. DISTRIBUTION OF LABOR AMONG THE ISD FUNCTIONS FOR EACH PAY PERIOD (1976 to 1980) FOR THE DEVELOPMENT OF THE HT RATING

HT 2 WEEK PERIOD	MAN-HOURS BY FUNCTION					MAN- HOUR TOTAL	% MAN-HOURS BY FUNCTION																													
	ADMN	ANAL	DSGN	DVLP	MOIA		EVAL	TRNG	ADMN	ANAL	DSGN	DVLP	MOIA	EVAL	TRNG																					
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	53	269	279	313	198	172	195	160	203	142	74	2	236	21	192	8	136	128	2	28	3	28	3	28	41	3	69	8	39	39	84	14	120	240	232	
	50	15	20	0	100	100	100	100	27	100	72	2	10	9	9	5	94	98	1	9	11	88	12	88	100	100	100	100	100	100	100	100	100	100	100	100
	106	312	351	314	198	172	197	160	203	142	74	2	265	213	136	144	127	127	31	31	25	41	25	41	100	100	69	100	100	39	100	100	134	240	232	

TABLE B-4. DISTRIBUTION OF LABOR AMONG THE ISD FUNCTIONS FOR EACH PAY PERIOD (1976 to 1980) FOR THE DEVELOPMENT OF THE HT RATING (continued)

PERIOD	ADMN	ANAL	DSGN	DVLP	MDIA	EVAL	TRNG	TOTAL	ADMN	ANAL	DSGN	DVLP	MDIA	EVAL	TRNG
71	8	208						216	3	96					
72	10	220						230	4	95					
73	4	377		14				395	5	73	3				
74	21	289	23	58				391	5	78	5				2
75	30	429		74			11	544	15	71	14				
76	82	367		64				513	4	88	6				
77	16	293		21				330	8	76	15				
78	35	320		64				419	13	80	6				
79	41	248		41				310	13	71	15				
80	29	280	24	61				394	9	73	6				
81	40	307		72				419	11	72	17				
82	40	244		53				337	16	66	17				
83	53	210		55				318	20	61	18				
84	87	263		79				429	37	46	16				
85	160	201		71				432	31	69	17				1
86	41	247		64			5	357	11	53	4				
87	63	89	4	8	1			165	38	55	2				
88	61	77						138	44	44	10				
89	35	35		8				78	44	64	6				
90	19	35						54	35	64					
91	20	51		5				76	26	67					
92	29	28						37	24	75					
93	32	223	9	75				32	100						
94	61	270	152	68				368	16	60	20				
95	20	570	18	188				800	46	46	17				
96	29	163	16	125				308	7	40	47				
97	35	199	174	168				350	15	42	35				
98	58	178	161	38	5			508	10	30	29				
99	33	276	73	94				513	6	53	7				
100	103	303	272	159	40			741	17	52	12				
101	55	215	242	263	144			884	36	29	36				
102	70	12	65	403	210	7		738	9	1	19				
103	69	45	29	602	548			1202	8	5	26				
104	67	17	32	368	163	9		632	5	1	43				
105	20	15	15	495	14	8		613	2	2	2				
106	16	87	41	384	289	81	4	894	9	1	32				
107	87	172	172	172	172	8		501	4	4	42				0
108	25	15	10	277	96			430	3	0	55				
109	15	4	96	423	83	38		678	5	0	73				
110	38	7	172	421	109			736	3	0	62				
111	27	24	323	372	10	40		789	23	3	57				
112	20	239	294	207	61	4		800	30	40	47				
113	25	42	99	501	15			713	3	28	24				
114	56	14	136	342	458			1003	5	5	34				
115	53	48	213	209	48			653	7	1	32				
116	135	48	216	230	384	4		979	20	1	32				
117	130	19	127	295	32			588	13	0	23				
118	125	5	185	343	1	9		481	8	0	21				
119	43	4	114	308	13	77		567	11	0	71				
120	64	4	102	303	13	20		472	17	0	54				
121	34	8	98	382	52	24	3	627	9	1	60				0
122	60	40	9	411	148	28		656	6	3	64				
123	40	56	9	496	112	8		664	15	4	74				
124	56	43	33	504	148	4		732	8	4	68				
125	43								5						
TTL	3231	10400	3482	10581	3356	426	23	31499	10	33	11	33	10	1	0

TABLE B-5. DISTRIBUTION OF LABOR AMONG THE ISD FUNCTIONS FOR EACH PAY PERIOD (1976 to 1980) FOR THE DEVELOPMENT OF THE EO RATING

EO 2 WEEK PERIOD	MAN-HOURS BY FUNCTION				MAN- HOUR TOTAL	% MAN-HOURS BY FUNCTION									
	ADMN	ANAL	DSGN	DVLP		MOTA	EVAL	TRNG	ADMN	ANAL	DSGN	DVLP	MOTA	EVAL	TRNG
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TABLE B-5. DISTRIBUTION OF LABOR AMONG THE ISD FUNCTIONS FOR EACH PAY PERIOD (1976 to 1980) FOR THE DEVELOPMENT OF THE EO RATING (continued)

PERIOD	ADMN	ANAL	DSGN	DVLP	MDIA	EVAL	TRNG	TOTAL	ADMN	ANAL	DSGN	DVLP	MDIA	EVAL	TRNG
71	8	9						17	47	52					
72	30	41						71	42	57					
73	6	94						100	6	94					
74	8	107						115	6	93					
75	9	66						75	12	88					
76	20	61						81	24	75					
77	26	87						116	22	75					
78	25	55						80	31	68					
79	17	63						80	21	78					
80	23	72						95	24	75					
81	41	102						143	28	71					
82	8	80						88	9	90					
83	21	112						133	15	84					
84	16	91						107	14	85					
85	5	91						96	5	94					
86	26	122						148	17	82					
87	20	132						152	13	86					
88	27	149						176	35	63					
89	46	122						192	23	63					
90	34	189						297	11	29					
91	44	130						211	16	47					
92	19	100						106	17	9					
93	8	100						100	16	71					
94	56	188						244	16	24					
95	49	167						216	19	29					
96	41	143						184	12	14					
97	49	165						214	16	56					
98	54	15						69	11	3					
99	80	86						166	21	23					
100	10	44						54	3	16					
101	32	48						80	11	16					
102	49	23						72	16	17					
103	56	62						118	16	17					
104	32	36						68	15	24					
105	32	51						83	11	11					
106	48	51						99	15	24					
107	58	8						66	17	7					
108	74	8						82	11	7					
109	78	49						127	8	1					
110	171	59						230	11	7					
111	41	76						117	10	6					
112	91	77						168	17	63					
113	9	76						85	20	13					
114	95	74						169	22	61					
115	62	75						137	21	52					
116	92	75						167	17	56					
117	140	65						205	18	89					
118	19	80						99	28	16					
119	19	70						89	8	19					
120	24	153						177	6	8					
121	196	194						390	46	32					
122	114	194						308	26	27					
123	124	124						248	8	25					
124	108	176						284	38	61					
125	39	199						285	13	16					
TTL	2877	2854	2608	7255	272	905	43	16814	17	16	15	43	1	5	0

TABLE B-6. DISTRIBUTION OF LABOR AMONG THE ISD FUNCTIONS FOR EACH PAY PERIOD (1976 to 1980) FOR THE DEVELOPMENT OF THE DP RATING

DP 2 WEEK PERIOD	MAN-HOURS BY FUNCTION					MAN- HOUR TOTAL	MAN-HOURS BY FUNCTION						
	ADMN	ANAL	DSGN	DVLP	MUJA		ADMN	ANAL	DSGN	DVLP	MUJA	TRNG	TRNG
12													
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71	17	70				87	19	80					
72	27	114				141	19	60					
73	19	184				203	9	90					
74		219				219		100					
75	2	243				245	0	99					
76	49	208				289	16	71					
77	41	310				351	11	88					
78	14	350				364	3	96					
79	21	62				83	25	74					
80	31	266				297	10	89					
81	32	296				328	9	90					
82	36	359				395	9	90					
83	15	247				262	5	94					
84	25	367				392	6	93					
85	13	458				471	2	97					
86	25	416				441	5	94					
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TABLE B-5. DISTRIBUTION OF LABOR AMONG THE ISD FUNCTIONS FOR EACH PAY PERIOD (1976 to 1980) FOR THE DEVELOPMENT OF THE DP RATING (continued)

PERIOD	ADMN	ANAL	OSGN	DVLP	MDIA	EVAL	TRNG	TOTAL	ADMN	ANAL	OSGN	DVLP	MDIA	EVAL	TRNG
71	42	383						425	9	90					
72	76	511						587	25	87					
73	126	360						486	12	74					
74	78	721						821	9	88		2			
75	108	812		22				921	11	88		0			
76	64	693		1				757	8	91					
77	86	550						636	13	86					
78	44	697						741	5	94					
79	44	305						349	12	87					
80	111	466		12				589	18	79		2			
81	148	465	91	137	1			842	17	55	10	16	0		4
82	148	420	100	120	30		36	854	17	49	11	14	3		
83	129	510	68	72				779	16	65	8	9			
84	131	567	36	99		5		838	15	67	4	11			0
85	211	538	9	80	6	4		902	30	59	0	8			0
86	182	637	8	81		4		921	19	69	0	10			14
87	192	363	13	80		5		768	25	47	1	4			9
88	129	384	95	31		13		886	23	47	12	3			0
89	212	424	202	31		16		995	15	69	22	5			2
90	104	473	54	38		6		795	12	72	7	8			0
91	130	544	14	57				751	15	89	1	2			1
92	118	594	14	19			10	751	15	89					
93	93	335	203					631	14	53	32				3
94	176	268	301				27	772	22	64	38				
95	124	365	74					563	22	80	13				
96	92	615	41	12	5			765	14	59	25	1	0		6
97	95	383	161	5				644	10	68	14	2			6
98	70	435	194	13			40	639	10	68	25	3			6
99	231	279	279	27			40	646	12	45	53	3			17
100	100	100	305	282	18		142	803	3	12	20	32	2		10
101	30	80	67	141	367	8	2	869	3	9	51	27	1		10
102	27	67	141	192	18			685	3	9	20	53	1		0
103	71	66	368	152	472	8		708	10	8	19	60	3		2
104	65	68	212	245	22		16	600	10	7	35	40	3		
105	60	45	188	395	50			737	4	9	25	53	6		
106	34	70	105	544	36			884	13	7	11	61	4		5
107	122	64	102	647	97		56	1044	3	7	9	61	9		2
108	39	42	57	686	113	29		985	5	6	5	69	11		0
109	58	62	42	695	121	2		991	4	7	5	69	12		0
110	42	70	57	722	133	2		1000	3		9	80	17		0
111	27	88	88	732	163	8		1094	9	0	19	57	17		3
112	69	5	177	634	133	8	43	1108	14	0	19	82	12		0
113	166		62	536	133	4	40	1093	16		5	94	16		0
114	181		82	558	145	4		863	16		4	70	6		
115	191		44	775	145	21		1438	13		8	58	25		
116	99		32	836	360	19		1021	9		4	58	27		
117	99		21	598	280	23	80	1018	10		2	59	16		7
118	106		16	610	91	115		878	5		5	63	8		
119	49		48	554	143	84		889	10		21	52	14		
120	89		192	468	131	9		1204	15		6	62	13		
121	187		84	758	162	13		998	12		6	70	5		
122	127		68	699	54	50		1015	8		0	60	21		
123	84		8	618	220	85		1164	13		7	73	4		
124	152		51	856	51	105		849	5		19	4	0		
125	45		634	834	2	168									
TTL	6023	19059	4809	15478	2651	816	1017	49853	12	38	9	31	5	1	2

TABLE B-7. DISTRIBUTION OF LABOR AMONG THE ISD FUNCTIONS FOR EACH PAY PERIOD (1976 to 1980) FOR THE DEVELOPMENT OF THE SA RATING

SA 2 WEEK PERIOD	MAN-HOURS BY FUNCTION				MAN- HOUR TOTAL	MAN-HOURS BY FUNCTION									
	ADMN	ANAL	DSGN	DVLP		MDIA	EVAL	TRNG	ADMN	ANAL	DSGN	DVLP	MDIA	EVAL	TRNG
12															
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TABLE B-7. DISTRIBUTION OF LABOR AMONG THE ISD FUNCTIONS FOR EACH PAY PERIOD (1976 to 1980) FOR THE DEVELOPMENT OF THE SA RATING (continued)

PERIOD	ADMIN	ANAL	DSGN	DVLP	MDIA	EVAL	TRNG	TOTAL	ADMIN	ANAL	DSGN	DVLP	MDIA	EVAL	TRNG
71	34	64		69	1		6	98	34	65		37	0		3
72	48	159			43			183	26	32			13		
73	95	190			38			328	28	57			14		
74	129	197			124	7		271	47	35			34	2	
75	48	185			154	21		363	13	50			27	3	
76	75	200			154	12		565	10	35			10	2	
77	59	176	35		127	6	1	570	5	30			16	8	0
78	41	83	84		40	58		775	5	10			5	5	
79	87	105	84		180	19		1152	17	3			23	9	
80	95	36	174		252	113		1158	17	8			49	8	
81	132	39	114		538	136		1100	13	2			26	19	
82	77	89	144		408	196		1262	10	2			20	12	
83	131	34	168		533	258		1592	12	0			19	7	
84	119	4	67		445	178		934	12	9			48	7	
85	94	51	82		462	200		957	9	5			40	7	
86	74		2		416	389		952	7				43	7	
87	128		4		471	325		1014	17	0			46	3	
88	154		3		454	402		1019	15	0			39	3	
89	255				227	249		771	33	0			44	5	
90	37		1		283	237		605	6	0			39	7	
91	271				342	246		893	30	0			27	3	
92	210				410	141		771	27	0			53	18	
93	196		12		476	409		1094	1	0			37	0	
94	207				404	365		1016	20	0			43	3	
95	126		40		409	281		881	14	0			39	3	
96	85		54		285	236		733	11	0			31	11	
97	97		72		250	123		561	17	0			38	6	
98	96		47		268	90		514	17	0			21	1	
99	128		72		520	72		788	16	0			50	2	
100	209	10	180		885	26		1364	14	0			64	2	
101	342		146		898	26		1470	23	0			57	3	
102	342		92		823	59		1172	21	0			53	5	
103	155		12		434	13		554	9	0			23	12	
104	115		44		420	23		608	16	0			28	9	
105	151		44		302	34		554	18	0			10	6	
106	64		26		282	50		471	13	0			15	6	
107	19		35		159	146		453	4	0			32	22	
108	77				74	103		315	2	0			10	10	15
109	117				289	44	80	508	15	0			8	3	
110	195				403	49	32	661	29	0			70	2	5
111	107				136	85	77	380	18	0			35	5	20
112	74				191	35		238	19	0			22	2	
113	12				246	210		504	5	0			48	41	
114	48				172	78		349	28	0			49	22	
115	31				139	82		328	9	0			42	23	
116	28				12	43		243	11	0			17	65	
TTL	5101	1297	1651	15263	6437	2155	196	32100	15	4	5	47	20	6	0

TABLE B-8. PERCENT OF CIVILIAN AND MILITARY LABOR DEVOTED TO EACH ISD FUNCTIONAL AREA--SAN DIEGO (1976 to 1980)

Year	Admin		Analysis		Design		Development		Media		Other	
	Civ	Mil	Civ	Mil	Civ	Mil	Civ	Mil	Civ	Mil	Civ	Mil
1976	61	53	15	45	4	0	7	0	1	0	12	2
1977	61	50	10	43	4	*	12	3	8	2	4	1
1978	57	49	12	39	4	*	17	6	4	1	5	5
1979	60	46	8	27	5	10	17	14	6	1	4	2
1980	56	43	3	9	5	8	25	33	7	4	4	3
Avg.	59	47	9	30	5	5	17	13	6	2	5	3

* < 1 percent

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