Abstract—The paper studied meta-synthesis theory and applied it to the field of combat experiment. Firstly, the paper divided experiment modes and experiment phrases. Then it divided experiment roles, experiment duties, and analyzed organization of small combat experiment. At last, it pointed out organizing and implementing methods of large joint combat experiment. All the ideas in this paper had been realized in computer network. The paper had top-floor traction functions and had been used to guide combat experiment development.

Index Terms—joint combat experiment, organization, implementation, method

I. INTRODUCTION

Methods of organization and implementation of joint combat experiment are important study results of meta-synthesis theory applied into the field of application of joint combat experiment. Part of study results are selected and form this paper. In this paper, joint combat experiment ideas, then experiment organizer forms total experiment conclusions. Finally, an example of joint combat experiment is given.

II. JOINT COMBAT EXPERIMENT MODES AND PHRASES[1]

A. Joint Combat Experiment Modes

Individual Study Mode: Individual study is a basic mode of joint combat experiment. It refers to single consumer or single person’s experiment activities on a platform of joint combat lab. In this mode, each experimenter goes about his experiment such as information consultation, information analysis, military mark, combat calculation, combat plan editing, combat simulation and evaluation, etc.

Collective Discussion Mode: Collective discussion is a main mode of joint combat experiment. This mode is based on individual study mode. In this mode, experimenters may go about their experiment through cooperative study or independent individual study. Generally each experimenter firstly puts up his own experiment ideas, then experiment organizer forms total experiment conception on the basis of many experiment ideas. Secondly the experiment organizer divides total experiment work into each experimenter. Thirdly each experimenter begins his divided study according to experiment division. Finally, with the help of synthetic discussion function, the experiment organizer collects all study results from each experimenter, he will sum up all study results and will form final experiment conclusions.

Antagonism and Deduction Mode: Antagonism and deduction mode is a senior mode of joint combat experiment. It is based on the above two experiment modes. In this mode, combat experiments are full of military encounters from both-sides or multi-sides. Experiment roles are divided into director side, blue side, red side, or multi-side. Generally, they begin to play a counter move according to combat plans. Their plans come from their respective collective decisions. Each move is arbitrated by white cell and they might use a simulation to assist in determining outcome of each move. An experiment might involve fighting the same campaign using two or more different strategies. After each move, they begin observing and analyzing combat situation and forming next round’s combat plan and decision by collective discussion till all experiment rounds end.

Demonstration Mode: The mode isn’t for pure demonstration but for improving experiment. The mode expands experiment function, means, object, domain and service scope. Demonstration experiment mode includes 3 essential experiment factors: experimenter, experiment means, experiment object, so demonstration mode is thought as a kind of expanded experiment mode.

B. Joint Combat Experiment Phrase

Joint combat experiment is divided into 3 phrases: putting up experiment ideas, arguing experiment ideas, forming experiment conclusions.

Phrase 1: Putting up experiment ideas. Main task is forming problem-tree, constructing experiment frame, forming initial experiment ideas.

Phrase 2: Arguing experiment ideas. Main task is arguing each problem in problem-tree by collective discussion, improving initial ideas and forming better plans, finally getting conclusions of each problem. Phrase 2 is a very important phrase.

Phrase 3: Forming experiment conclusions. Main task is summing up conclusions of all problems and getting total experiment conclusions.

III. EXPERIMENT ROLES AND ORGANIZATION[2]

A. Experiment Roles

We have known that there are 4 modes of joint combat experiment. They are as followings: individual study mode, collective discussion mode, antagonism and deduction mode, demonstration mode. In the above-mentioned 4 modes, collective discussion mode is the most representative mode because it makes experimenter
almost use all functions of joint combat experiment platform. So we select this mode as a typical example to elaborate general organizing and implementing method of joint combat experiment.

In collective discussion mode, experiment roles are divided into presenter, discusser, technical supporter.

**Presenter:** There is only one presenter in one times of experiment. Often only that person organizing experiment subject acts as an experiment presenter. Military expert may also act as the experiment presenter in need. Before discussion, the presenter is responsible to make experiment plans, disintegrate experiment problems, and assign work to experimenters. During discussion, the presenter guides and presents all activities of discussion according to experiment conception and frame. He is deputy for summarizing all discussion problems and putting up next step of discussion problems. After discussion, he summarizes answers of all problems and forming total experiment conclusions. At last, he must put up the next discussion plan and problems.

**Discusser:** In general, only military persons taking part in experiment act as discussers. The number of discussers is decided by the number of discussion problems, experimenters and domain experts. Generally the number of discussers shouldn’t surpass 40 persons. But the number of auditors is not limited in collective discussion. Before discussion, work of discusser is doing enough preparation according to presenter’s arrangement. He needs looking up materials, information analysis, combat calculation and puts up experiment conception. During discussion, work of discusser is introducing his own experiment conception. At the same time, he should take part in other discussers’ discussion activities. After discussion, work of discusser is analyzing discussion results and getting initial discussion conclusions.

**Technical Supporter:** Generally technical person acts as technical supporter. Often there are 2 or 3 technical supporters in one times of experiment. Their main duties are helping experiment presenter operate computers, run software, manage experiment subjects and record discussion information.

**B. Experiment Organization**

According to experiment mode and experiment phrase division, one times of experiment is divided by 3 phrases: putting up experiment ideas, arguing experiment ideas, forming experiment conclusions.

**A) Putting up Experiment Ideas:** Putting up experiment ideas includes 3 steps. Detailed description is as followings.

**Disintegrating Study Problem, Forming Discussion Frame.** According to division of experiment, every discusser puts up his problems by individual study. Then all problems are converged into a total problem frame. In the process of convergence, directories and frames of experiment subject should be list out one by one according to their classed levels. So a series of study problems will be list out under their respective directories, and an entire problem tree will be formed. When confronting with complicated problem, we should closely disintegrate the complicated problem into many small questions as simple as possible. These small simple questions may be accurately answered in a short passage of words, a choice, a group of data, a simple picture or an information form. Problem tree may be put up by presenter or his agent, or may be unrestrainedly produced by collective discussion. As soon as the problem tree is got, an initial discussion tree will be got. The initial discussion tree is also called discussion frame.

**Cutting out Problem Tree.** Cutting out problem tree means *tailoring* work. We need delete or add some problem branches and knots by collective discussion, expert evaluation or collective hand vote. The *tailoring* work generally is finished by experiment presenter or his agent, and it may be finished by experimenters’ collective discussion or collective votes.

**Forming Initial Experiment Ideas.** After tailoring process, problem tree will become initial experiment ideas. Since then, all experimenters begin solving their respective problems by individual study according to division of presenter. They will do enough preparation work and obtain their answers. Some experimenters need looking up some information and materials in the lab information-lib, and accumulate enough primitive materials and knowledge. Sometimes they need doing some calculation with the lab model-lib. They need taking good use of their knowledge and get solutions to their respective problems. Their solutions would include 2 parts: Part 1 might be their viewpoints and conclusions, Part 2 might be description of their arguments. When all solutions have been gathered into total conceptions, initial experiment ideas will be formed.

**B) Arguing Experiment Ideas:** Arguing experiment ideas is very important. In this phrase, initial experiment ideas of Phrase 1 will be used into Phrase 2. Implementing steps of Phrase 2 are as followings.

**Collective Discussion:** Generally experiment presenter presides collective discussion in experiment hall, synthetic discussion rooms or synthetic combat rooms. Often every discusser firstly introduces his distributed problems, then he elaborates his solutions and conclusions, finally domain experts begin discussing whether his solutions and conclusions are correct. Discusser may have one or more solutions and conclusions, other discussers can give their advice on improving, modifying and amending his solutions and conclusions. During the procedure of discussion, problems may be discussed one by one. When a specified problem is discussed, one discusser can give his viewpoints on the specified problem. On the other hand, discussion topics may be discussed one by one, or whole experiment subject may be discussed in one times of discussion. When discusser introduces his viewpoints, he may use all needed lab functions to prove his viewpoints. For example, he may call information looking-up function, combat calculation function, simulation and evaluation function to live demonstrate his experiment. Of course, he may also call for his own or other person’s study results to assist in his viewpoints or discussion.

**Statistical Analysis and Further Argument:** Experiment presenter should summarize all discussers’ discussion and
forms final conclusions on one specified problem. Then the presenter or his agent should carry out statistical analysis on the specified problem. The statistical analysis can display distribution of expert opinions. Type of problem may be description-type question, plot-chart-type question or combat organization-into-group-type question, etc. When confronting with the three types of questions, we should again discuss those questions which produce bigger differences of expert opinion. When confronting with statistical analysis in choice-type or data-type question, we should again discuss those questions which produce sharper deviation and less common consensus in expert answers, and so on, till we have got distinct answers to all questions. At last, we should put the viewpoints, data, argument grounds, common consensus into conclusion-area of experiment system and save them.

In the whole of argument phrase, information-support function, model-support function, military assignment-support function and discussion-support function provide collective discussion with strong support. When discusser introducing his conception and plan, he may use discussion-support function and military assignment-support function to make his demonstration more reasonable. When experimenter summarizing his viewpoints, he may use many newer complement and argument. When support function and model-support function to provide raise some doubts or suspicions, he may use information-support function to make his demonstration more reasonable. When discussing introducing his conception and plan, he may use information-support function and model-support function to provide raising some doubts or suspicions, he may use information-support function to make his demonstration more reasonable.

(C)Forming Experiment Conclusions: After all questions have been discussed and major common consensus has been obtained, we need sorting out and drawing total conclusions. Firstly we use result-process branch system to help us sort out conclusions of all questions. The branch system will automatically collect every question’s answers and forms total conclusions, then a study report will be automatically produced. At the same time, directories and main viewpoints of the study report will be automatically produced. If necessary, we should modify the study report again through further collective discussion till we get the final version.

IV. AN EXAMPLE OF LARGE JOINT COMBAT EXPERIMENT

The above analysis may be simply generalized to 4-mode and 3-phrase theory. This theory is a basis of one times of small combat experiment. Usually large joint combat experiment is composed of many small combat experiments, so 4-mode and 3-phrase theory will be synthetically applied to large joint combat experiment.

Large joint combat experiment is often organized in the form of experiment subjects, special experiment topics or experiment items. Namely, a large experiment subject is divided into many small special experiment topics, and small special experiment topic may be divided into smaller experiment items if need.

Now we give an example of large joint combat experiment. Assuming that a large joint experiment is a subject and the subject is divided into 5 special topics. They are: target analysis topic, combat calculation topic, combat plan study topic, simulation and evaluation topic, experiment summary topic. Taking target analysis topic as a typical example, we can elaborate its implementing method. Furthermore, we can deeply understand implementing method of the whole large joint experiment.

(A)Target Analysis Experiment Topic: Military persons are responsible for target analysis topic. They mainly study which targets would be struck. Their purpose is forming a striking target set. Specific steps are: putting up a striking target set, arguing rationality of the striking target set, forming conclusions of striking target set. Detailed descriptions are as followings.

Putting up a Striking Target Set: Implementing steps are: experimenters begin their respective study in individual study mode; presenter forms initial conceptions of target analysis after summarizing all individual results, experimenters roughly select initial striking targets in collective discussion mode; experimenters look up information of roughly selected targets and begin individual study again; experimenters carefully select striking targets by one or more times of collective discussion; after several rounds of individual study and collective discussion, presenter forms a striking target set.

Arguing Rationality of the Striking Target Set: A striking target set has been got in the previous phrase. We should prove whether the striking target set is rational. This demands that we should use quantitative analysis method and qualitative analysis method to prove its rationality. Under this condition, we need building up a target-value-evaluation system and obtain its help. With the help of the target-value-evaluation system, many field experts begin evaluating target’s value, obtain statistical analysis, and get a target value sequence. On the basis of the target sequence, we can get a final target set through careful target selection and collective discussion.

Forming Conclusions of Striking Target Set: On the basis of arguing rationality of the target set, a study report on target analysis topic will be formed. The report’s name is Study Report of Target Analysis Topic.

In target analysis experiment topic, experiment method of each phrase isn’t quite the same. The purpose of phrase 1 is putting an Initial striking target set. So a quantitative analysis method is mainly used in phrase 1. The purpose of phrase 2 is arguing the striking target set. So integrating method is used in phrase 2. The integrating method is namely integration method of quantitative analysis method and qualitative analysis method. We can see, individual study mode and collective discussion mode are alternatively used in phrase 1. For example, firstly use individual study, secondly use collective discussion, thirdly use individual study again, fourthly use more collective discussion, and so on. We can also see, 4-mode and 3-phrase theory is synthetically applied to target analysis topic.
In a word, target analysis experiment topic not only embodies synthetic application of experiment theory, but also reflects total method of joint combat experiment.

Although there are some differences among 5 different experiment topics, their experiment method is basically similar. In order to fully see total method of joint combat experiment, the following parts will give a brief description on other topics.

(B) Combat Calculation Topic: Combat calculation topic is responded by military persons and technical persons. Military persons are responsible for forming striking plan of targets, and technical persons are responsible for combat calculation which includes combat calculation of armed services and all branches.

This topic mainly uses qualitative calculation method and collective discussion method. Its specific implementing steps are: determinate demands of damage; sort out important order of striking targets; select striking weapons; analyze striking effects (include rough calculation and accurate calculation); optimize weapons selection.

When these steps have been finished, a striking plan will be formed and combat calculation report will be got.

(C) Plan-Studying Topic: The purpose of plan-studying topic is sufficiently arguing a firepower striking plan and forming a combat plan. During the argument course, military persons and technical persons jointly determinate numbers of forces and weapons according to results of combat calculation, results of target analysis as well as military postures of both-sides or multi-sides. They not only determinate combat resolve, but also make combat plan.

With the help of function of information-support, model-support, military assignment-support function and discussion-support function, they will further their argument on rationality and closeness of firepower striking plan.

(D) Simulation and Evaluation Topic: Simulation and evaluation topic is responded by technical persons. When technical persons have input all parameters into combat models, software systems begin running computer-deduction, combat-calculation, statistic analysis, data record. At last, software systems begin saving combat effects. All these works are automatically finished and whole process doesn’t need person intervention.

(E) Experiment Summary: When all experiment topics have been finished, the experiment presenter will sum up all experiment results. Its steps are: replay experiment course and extract experiment results; synthetically analyze experiment data and form total conclusions; write an experiment report; submit, censor and save the final experiment report.

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