A Knowledge-Based Systems Approach to Educating Creative Legal Minds

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ABSTRACT
Rapidly changing global societies of this century require us to have many good lawyers. "Good" lawyers must have creative legal minds. It is important to educate law students so as to enhance creativity as well as to ensure their knowledge of the law. We have, therefore, established a project on "the development of a legal education method for fostering creative legal minds." In this paper, we would like to present the results of one of our studies as an application of the legal knowledge-based system developed by the authors to promote students creative legal minds. The basic idea is as follows: The traditional legal education in Japan, which belongs to the continental, statutory law culture, has been based on the lecture method, which uses a top-down implantation of legal knowledge. Our new approach involves an integration of four methods: problem-solvings, Socratic interpretation and discussion, which together lead to a more interactive, bottom-up development of legal knowledge using the legal knowledge-based system (LKBS). In this paper, the authors introduce a LKBS (LES4) they developed, discuss the applicability of the LKBS to legal education for creative legal minds and report an example of training of creative ability of students in the systematization of legal knowledge.

Categories and Subject Descriptors
L.2.1 [Applications and Expert Systems]: Law and Legal Education.

General Terms
Design, Experimentation.

Keywords
Legal Expert System, Knowledge Based System, Creative Legal Minds, Law Education.

1. INTRODUCTION
Society is changing rapidly, and globalization is surging forward. It has become very important for legal practitioners to cope with such change in the time of intense transformation; that is, to provide appropriate solutions to legal problems that deal with the rapid progress of society.1 There are many criteria for being an excellent lawyer, but the capacity for creative and flexible legal thinking that is adaptable to this rapidly-changing society is especially in demand. With the backdrop of this era, cultivation of this creative legal thinking ability is offered as one of the vital educational objectives of law schools. We refer to education that cultivates this creative legal thinking ability as "creative legal education."2

We have thought that the research (and results) of artificial intelligence could be applied toward this objective of implementing creative legal education. For this reason, we have brought to fruition some aspects of the development of the legal knowledge-based system. We have thought, "Couldn't we contribute to the realization of this objective utilizing these accomplishments, or developing and expanding them further?" The traditional legal education in continental law countries (sometimes referred to as civil law countries), to which Japan belongs, is based on lecture methods. In lectures, professors pass on to students the legal knowledge that they themselves possess, and the students have to understand and remember it. This is a top-down implementation of legal knowledge.

A new approach is an integration of problem methods, Socratic methods and discussion methods. Ultimately, it is designed to be a bottom-up development of legal knowledge, using a knowledge-based system.

1This is especially the case for Japan. There have been numerous cases in which Japanese companies lost legal disputes in the U.S. and other countries, causing Japanese legal professionals to become viewed as unreliable in comparison to their American counterparts. The demands of the financial world have pushed the political establishment to a systematic reform that will establish a graduate law school attempting to train a greater number of skilled lawyers.

2Legal Expert System LES-4th and others have been developed through this research project(1, 2,3,4,5,6).
The basic idea is represented above in Figure 1. (1) Students are to start from statute provisions. (2) Students try to compose statutory rules with the goal of establishing a deductive system. (3) Through these composition activities, students can find the intra-relation of rules from provisions, on the one hand; and the inter-relation of rules, including meta rules, on the other hand. (4) Finally, students can establish appropriate (integrated) rules which constitute a deductive system of law. This means that students understand the real statutory meaning and can explain it correctly.

A "creative legal mind" is the thinking ability to properly solve legal problems by creating new legal rules. A creative legal mind includes not only proposing new legal rules, but also constructing a new legal structure in a lawyer's brain.

In this paper, we will clarify that the legal knowledge-base can contribute to the aspects of creative legal education. We will thereby introduce practical examples in which the legal knowledge-base contributes to creative legal education.

Before we begin, let us define our conception of legal creation. According to the authors, legal creation is the establishment of legal propositions that cannot be deduced from the existing legal system. Legal propositions are laws expressed in sentence form. To carry out the formation of legal propositions, a certain reasoning process is required, and when sentences are devised following that process, they become legal propositions. Legal propositions are not limited to statutory laws, which are laws—such as the Constitution, the Civil Code, and the Penal Code—that are enacted by the state. Because statutory laws are expressed with abstract terminology, those who seek to apply a statutory law must perform an interpretation of the law that embodies the meaning of the terminology within it and actually and concretely adapt the law to a particular case. Also, the person interpreting the systematization of the law through the systematic relationship among the various individual legal rules within the statute. Legal propositions are to be established through these interpretive processes by virtue of the authority of the person applying the law.

The establishment of legal propositions carried out through this sort of legal application process is referred to here as legal creation. Creative legal thought, then, is legal thought that establishes these kinds of legal propositions and resolves disputes appropriately.

2. APPLICABILITY OF LEGAL KNOWLEDGE-BASE TO CREATIVE LEGAL THOUGHT

Let us consider how the legal knowledge-base can be applied to creative legal education. The purposes of this application are divided into two main categories. One is the acquisition of fundamental knowledge and skills pertaining to legal thought as a premise for creative legal thought. The second is the promotion of the creative side of creative legal thought. It can be said that the former is the acquisition of the fundamental technique and basic form of legal thought necessary for performing the latter creative legal thought.

First, in order to properly acquire the fundamental knowledge and skill of legal thought, it is necessary on the one hand to understand the systematic structure of legal knowledge, and, on the other hand, to practice actual legal thought through problem-solving case simulations. In the former, this is accomplished by (1) understanding the general logical structure of legal knowledge, (2) understanding the general structure of legal reasoning, and (3) understanding the concrete knowledge structure of positive law (understanding the concrete structure of knowledge in specific fields such as the Civil Code, the Commercial Code, and so forth).

4 Because there is a logical structure in terms of law that is common among the Civil Code, the Commercial Code, the Penal Code, the Constitution, and other such laws, this point is to understand the type of structure. However, what we call logical structure here is not restricted to the pure syntactical aspect, but also includes the function or meaning of the specific common predicate that logically systemizes legal knowledge.

5 Understanding of this formal structure is useful in comprehending the law and solving concrete problems. It is also useful for proving proof of a legal conclusion, as well as closely grasping the framework that is used when considering and establishing new legal propositions.

6 Using the legal knowledge-base, one can clearly grasp the various rules and appropriate order used for reasoning, and by specifying these, can draft a clear report. Students become able to write systematic reports because they utilize the systematized knowledge and grasp this structure of reasoning.

7 That the systematization of legal knowledge is an act of legal creation has been expressed previously.

In order to establish legal knowledge, based on the understanding of the general logical system that accompanies the legal knowledge, it is necessary to carry out this creation by synthesizing two sides: the process side that embodies the meaning of the law, and in order to apply it to concrete examples; and the side that systematizes legal knowledge by placing the various legal regulations in their systematic relationship, under the framework of the general legal knowledge logic system, in order to make the solutions of the various concrete examples justifiable. Better understanding is promoted through comprehension of both the general logic system and legal structure of legal knowledge and the basic framework of legal creation, and also through the application of legal knowledge to concrete problem-solving. It can be beneficial to use the knowledge-base system in this area.

3.2 Learning of systematization of legal knowledge

We previously explained that the creative side of legal interpretation is the methods of creating the meaning of the law and the methods of systematizing laws, but this paper will abbreviate the creation side and focus on the systematization of legal knowledge.

Systematic legal thinking, is not something scattered among individual bits of legal knowledge, but rather, is something within its systematic relations. Legal specialists already possess, in addition to common-sense legal terms, the principle knowledge necessary to integrate legal knowledge, and in utilizing this have the ability to systematize and comprehend all kinds of legal knowledge\(^8\), especially legal articles.

Here, systematization is the construction of a deductive-reasoning system. This deductive-reasoning system is not a pre-existing entity determined beforehand through legal problem-solving, but is appropriated through a fixed framework and constructed in concrete detail in order to justify the problems' solutions. Furthermore, although the legal knowledge system is a dynamic system in comparison to the deductive-reasoning system of domains such as mathematics and natural science, it could be considered in certain situations, and from certain points of view, to have a deductive-reasoning system similar to that of natural science. This systemic ability is the ability to construct a deductive-reasoning system. Deductive reasoning in law is not a given system. To systematize the law is not to recognize a given system, but to create a system. People who attempt to understand the law must have it themselves. Actual legal regulations in themselves do not constitute a strict system. People who apply and interpret the law systematize it themselves. The systematization of law is creative legal thought.

6 This knowledge includes meta knowledge related to the application of knowledge. It can be thought that systematic legal thought may be the ability to compose reasoning of deductive justification using this meta knowledge.

Students who aspire to be the legal professions must develop this systematic thinking ability in themselves. Law schools must also provide this training. In order to have this systematic legal thinking in students, first, it is useful to (1) explicitly present this general system structure of legal knowledge. Moreover, it is also effective to (2) actually put this legal knowledge to use: that is, to practice reasoning through the application of legal knowledge to problem-solving. In addition, (3) it is vital for the students themselves to practice systematization of legal knowledge. By carrying out the systematization themselves, students can develop systematic legal thought.

Utilization of the legal knowledge-base is effective for (1) and (2), while creation of the legal knowledge-base is effective for (3). We will explain (3) in more detail, namely by discussing examples of legal systematization by students applying the CISG to the hypothetical problems.

4. EXAMPLES OF TRAINING OF ABILITY IN LEGAL SYSTEMATIZATION

At first, the target domain is the CISG. Let us consider three types of examples, such as those in the Table 1 below\(^7\).

(*Table 1. Three Example Problems*)

<table>
<thead>
<tr>
<th>Date</th>
<th>Problem 1</th>
<th>Problem 2</th>
<th>Problem 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/1</td>
<td>On April 1, A sent a letter to B indicating that A would sell farming</td>
<td>Same as Problem 1</td>
<td>Same as Problem 1</td>
</tr>
<tr>
<td></td>
<td>machines for $10,000.</td>
<td>Same as Problem 1</td>
<td>Same as Problem 1</td>
</tr>
<tr>
<td>4/7</td>
<td>On April 7, A called B and said, &quot;I sent a letter indicating that I would offer</td>
<td>Same as Problem 1</td>
<td>Same as Problem 1</td>
</tr>
<tr>
<td></td>
<td>to sell farming machines for $10,000, but I would like to withdraw my offer.&quot;</td>
<td>Same as Problem 1</td>
<td>Same as Problem 1</td>
</tr>
<tr>
<td>4/8</td>
<td>The letter with the offer arrives to B on April 8.</td>
<td>Same as Problem 1</td>
<td>Same as Problem 1</td>
</tr>
<tr>
<td>4/9</td>
<td>On April 9, the letter that A sent on April 7, withdrawing A's offer, arrives to B.</td>
<td>Same as Problem 1</td>
<td>Same as Problem 1</td>
</tr>
<tr>
<td>4/10</td>
<td>On April 10, B called A and said, &quot;I accept your offer.&quot;</td>
<td>On April 10, B called A and said, &quot;I accept your offer.&quot;</td>
<td>On April 10, B called A and said, &quot;I accept your offer.&quot;</td>
</tr>
<tr>
<td></td>
<td>Was the contract completed, and if so, when?</td>
<td>Was the contract completed, and if so, when?</td>
<td>Was the contract completed, and if so, when?</td>
</tr>
</tbody>
</table>

\(^7\) In reality, this is taught using six examples, but for ease of explanation, we will simplify the demonstration by using only three examples.

\(^8\) In actuality, this is taught using six examples, but for ease of explanation, we will simplify the demonstration by using only three examples.

\(^9\) Through this systematization, in Problem 1, one can deduce the conclusion the contract was concluded on April 10th but itself is correct. However, the Article 15 (1) rule, "The offer becomes effective when it reaches the offeree," is applicable in reality, but has not been applied at all here. Thus, this systematization overlooks the fact that "the effectiveness of the offer" is an essential requirement for the completion of a contract. We then alter the hypothetical problem, presenting Problem 2 to the students and directing them to solve it. In this new example, "The contract is not concluded" is the correct answer, but the above systematization will not lead to that conclusion. That is where students revise their knowledge-base. Figure 4 is the students' revised systematization.

In Figure 4, the students add the offer's effectiveness as one requirement to conclude the contract. That is, they establish a statute regarding contract conclusion, the "contract law statute," that integrates the rules. "An offer becomes effective when it reaches the offeror." (15(1)) and "Consent becomes effective when it reaches the offeror" (18(2)), and succeed in a systematization that is improved from the previous response. With this systematization, the correct conclusion can be reached in both Problem 1 and 2. We then present Problem 3 to the students and ask them to reconsider. Keeping this systematization as it is, the correct conclusion does not emerge because students cannot properly address the fact that the cancellation of the offer...
dissolves the contract's validity. The students are made to attempt systematization again, and they submit response.

Through this systematization, the cancellation of the offer is effective, and the offer's effectiveness is lost, thus proving that the contract is not concluded. Students realize through this systematization that not just validation of the offer, but the offer's effectiveness at the time of agreement is needed to conclude the contract, and on that basis have arrived at a much more appropriate systematization as shown in Figure 5. Though the scope may be limited, this manner of constructing a legal knowledge-base and applying it to various problems achieves the legal thinking ability to systematize the law.

5. A SOFTWARE SYSTEM FOR SUPPORTING OUR EDUCATION METHOD

This section describes a software system for supporting our education method. The software system is currently being implemented on a Web application server.

5.1 System Overview

While our education method needs an ability to construct a knowledge-base, it is not so easy task for a student as a novice programmer. To alleviate the task, an editor and an inference engine have been designed on a Web application server. As a Web application server, Zope[6], which is an open source Web application server written in python, is selected as a pilot home. Zope is composed by ZODI, which is an object oriented DB manager and ZPublisher, which outputs HTML, files from ZODI. Plenty of knowledge-bases, which are generated or abandoned by students in our education method, can be stored in ZODI as objects. Furthermore, Pixel[7], which is a product to construct a Portal site on Zope, is used to manage user accounts. By using Zope/Pixel, the learning history of each user will be accumulated.

Since the accumulated learning history can be used for analysis of learning effect, example problems or instruction strategies will be refined based on the analysis.

5.2 Structured editor on Web

For a student of graduate law schools, it is not so easy to understand the syntax of a logic program such as Prolog and the notion of "term." If all of students knew the syntax and notion of "term," our method could be directly applicable. However, since few of students are assumed to have programming knowledge, some assistant systems should be prepared. In such a system, editing knowledge should be utilized.

Since HTTP is mainly implemented by only POST and GET operations, the interaction between the server and the user is very restrictive to implement an editor. A structured editor is well-known as an editor for Lisp programs and it works on teletype terminals. In other words, the structured editor of Lisp works well on a half duplex communication line. The behavior of the structured editor is very simple. It only reads the user's command and writes the result of user's command. Since the requirement portion of a rule proposition can be represented as a list data structure[5], the structured editor of Lisp is suffice to edit the requirement portion of a rule proposition. The current commands are (1) deleting an expression, (2) introducing a conjunction and (3) introducing a disjunction, and (4) introducing a negation.

After editing rule and fact propositions, students must designate a collection of rule and fact propositions. Since Zope has an object oriented ZODI, a hierarchical knowledge-base can be easily constructed by using the inheritance function.

5.3 Inference Engine

After the temporary construction of a knowledge-base, the correctness of the knowledge-base can be verified through actual
simulations. In order to solve or trace the given query, an inference engine is needed. As all of interfaces are on a Web application server, light weight inference engine is desirable. PyLog[4], which is a Prolog interpreter written in python, converts a Prolog program into python programs. As the knowledge-base is compiled into a python program, the query with respect to the knowledge-base can be directly executed as a server side script like ASP, JSP or PHP. If the query is solvable successfully, its proof tree will be presented to the user like LES-5[1][2][3][4][5]. As a result, students revise their knowledge-bases according to the result of the inference engine.

6. CONCLUSION

Legal study up to this point has been mostly a matter of the professor simply explaining law by presenting students with legal knowledge acquired through many years of study or research and telling them, "Here's what the law is." The students would imbibe that teaching, undergo rote learning, and for some students it would just go in one ear and out the other. At any rate, students' attitudes toward education were continually passive, and their ability to creatively think for themselves was poor. Thus, the traditional legal teaching methods, which use a top-down approach, have been mostly unsuccessful.

In educational training of legal systematic thought, utilizing the legal knowledge-base system, as outlined in this paper, through application to multiple examples and problem-solving exercises, and by constructing the legal knowledge-base, students can learn and develop creative systematic thinking. Consequently, this legal knowledge-base system is designed to operate from the bottom-up, in contrast to the traditional top-down teaching methodology.

We began partly testing this educational approach in both the "Legal Method" class and "Law and Artificial Intelligence" class at Meiji Gakuin University graduate law school, which opened in April 2004; we also used this approach in the "Law and Computers" class at Keio University School of Law. We would like to say that upon its actual utilization in a classroom setting, law school students began to find their own mistakes and gradually corrected them to achieve better systematization rules. Students' reaction have been positive, including refreshed interests, and, overall, students have found this training useful in learning and acquiring systematic knowledge and general structure. Consequently, we believe that its effectiveness has, to some degree, been confirmed in the educational domain.

Regarding systematic thinking, aside from the systematization issues of legal articles and concepts explained in this paper, there is also a need for legal thought that inductively discovers laws (principles) from examples of individual judgments. Training in this legal thinking ability is the goal of education that uses case method and the Socratic Method, especially in countries that practice common law (England, the United States, etc.).

Introduction of this training is currently being tested in our country, especially in law schools. The application of information technology, especially artificial intelligence theory and technology, to this education is in demand. We are pushing forward with this experiment. Systems supporting the Socratic Method were touched on in another report. We would like to introduce education of legal deduction reasoning in a future manuscript.

The aforementioned matter is the systematization side of legal interpretation; of course, legal creation education is not on this systematization side, but rather the embodiment side, and in this area, having students create embodiment rules for concrete example problem-solving is not only possible, but also essential. The legal education base, or the construction of the legal education base, is also thought to be effective toward this purpose. Educational utilization on this side will become a key issue in the not-too-distant future.

7. REFERENCES