

The Cultural Inheritance and National Responsibility in the Family Tree: Guarding the "Ancestral Roots" and Forging the "Spirit of the Nation"

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Abstract: This case study uses the "family tree" as the core carrier to construct a teaching path that integrates the Data Structures course with Chinese family genealogy culture. It explores the method of integrating ideological and political education (IPE) by extending from the engineering case of "social responsibility" to "patriotism and familial affection." The case first explains the correspondence between the tree structure of family genealogy and the tree structure in data structures, clarifying the relationship between the concepts of ancestral progenitors, ancestors, and descendants in genealogy, and the root, parent, and child nodes in a tree. Based on the data processing needs of family genealogy, the core operations such as tree creation, pre-order traversal, and node searching are taught, simultaneously introducing the family inheritance stories and deeds of ancestors recorded in traditional genealogies. The teaching incorporates the practice of building digital family genealogies, guiding students to recognize the social responsibility of technology in preserving cultural heritage. This leads to an understanding of the connection between family memory and national history, establishing the link between professional learning, cultural inheritance, and national responsibility, and creating a "profession with warmth and IPE with depth" classroom environment.

Keywords: Data Structures; Family Tree; Ideological and Political Education; Patriotism and Familial Affection; Social Responsibility

1. Introduction

This case study focuses on the "tree" concept within the Data Structures course, utilizing the "family tree" as a practical teaching tool to construct the teaching scenario. The background can be developed progressively from the course, knowledge points, and case study perspectives, addressing theoretical, practical, and research aspects, while also clarifying the characteristics of the target audience for the case.

The "Tree and Binary Tree" section is a core chapter in the Data Structures course. Knowledge points such as hierarchical structure, traversal algorithms, and node operations are crucial for students transitioning from linear structure thinking to nonlinear structure thinking. The abstract nature of this chapter, with concepts like root node, subtree, and pre-order traversal, makes it difficult for students to grasp through theoretical explanations alone. Moreover, traditional cases often employ "file directories" or "expression parsing" as technical scenarios, which can lead students to feel disconnected between knowledge and practical application. The "tree" structure at the core of this chapter aligns naturally with many real-life scenarios, requiring a case study that combines both cultural warmth and technical attributes, converting abstract knowledge into tangible applications. This provides the conceptual foundation for designing the "family tree" case[1].

From a practical perspective, family genealogy, as a cultural medium recording family lineage, naturally aligns with the definition of "tree" in data structures, with the "ancestor—branch—member" tree structure matching the "root node—subtree—node" elements in the data structure. This inherent compatibility quickly helps students establish a cognitive understanding of the knowledge points. Additionally, traditional genealogies face challenges of preservation and inheritance disruption, making digital genealogy construction a necessity for cultural heritage. The use of a tree structure to realize the storage, traversal, and query of family genealogies is a typical example of technology serving social responsibility. From a research perspective, existing data structure cases often focus on technical applications, with few cases combining cultural elements. The "family tree" concept,

which carries the idea of "honoring ancestors and loving family—family and nation as a whole," facilitates the value progression of "technical learning—social responsibility—patriotism," filling the research gap in similar cases.

This case study is suitable for second-year undergraduate students majoring in computer science or software engineering. This group has already mastered basic programming skills in C or Java and possesses the ability to write simple code. They are currently studying data structures and are at the initial stage of understanding nonlinear structures like trees. Cognitively, second-year students are active thinkers with a high interest in cultural practice themes. They are beginning to form a sense of professional responsibility and can understand the practical significance of "technology serving culture." This provides a solid foundation for achieving the dual goals of "professional knowledge + ideological and political education" in the case study.

2. Case Introduction: Anchoring Dual Objectives to Answer "Why Integrate"

This case focuses on the core knowledge points of the "tree" chapter in the Data Structures course, with the theme "Guard the 'Ancestral Roots,' Forge the 'Spirit of the Nation.'" The case aims to solve two major issues: First, the common problem in data structure teaching of "disconnect between technology and value" — traditional teaching emphasizes algorithmic logic in tree structures, often leaving students in the dilemma of "understanding code without understanding its application." Second, the real-world need for preserving Chinese traditional culture — genealogies, as "living histories" of families, face issues such as paper deterioration and gaps in inheritance, which require technological empowerment for protection[2].

Based on these issues, the case defines dual objectives:

Professional teaching objectives: Students will master core operations such as the definition of trees, node construction, traversal, and searching, enabling them to apply tree structures to solve basic data storage problems.

Ideological and Political Education objectives: Using the family tree as a medium, students will understand the cultural value of family traditions, establishing an understanding that "family fate and national development resonate in harmony," and fostering a deep sense of patriotism and a sense of responsibility for using technology to serve society.

To naturally connect professional knowledge with ideological themes, the case introduces the scenario of "paper genealogy restoration needs" in a real-life context: "The Zhang family's paper genealogy has been damaged by pests and is now unclear. How can we use the tree structure we've learned to clearly preserve and pass on the family story of 'farming and studying as a family tradition'?" This serves as a seamless bridge between the technical content and the ideological theme, highlighting the significance of "empowering cultural inheritance with technology."

3. Core Integration: Anchoring Knowledge and Ideological Education, Clarifying "What to Integrate"

This case uses the "family tree" as a bridge to construct a precise mapping system between "professional knowledge points" and "ideological elements," avoiding the forced insertion of ideological content. The specific integration is as follows.

4. Practical Implementation: Constructing a Three-Dimensional Pathway to Achieve "How to Integrate"

Taking the "Development of the Zhang Family Genealogy Digital System" as the main practical line, the three-dimensional pathway of "knowledge preparation — technical practice — value enhancement" is used to achieve "natural integration, solid learning, and deep understanding"[3].

4.1 Knowledge Anchors: From the Essence of Tree Structures to the Cultural Mapping of Family Trees.

In this section, the core knowledge points of tree structures are first solidified, followed by the design of layered learning tasks that account for students' varying levels of understanding. This approach aims to achieve a progression of "knowledge understanding — ability adaptation — cultural connection," allowing students at different levels to grasp the cultural connotations of family genealogy within the context of technical learning.

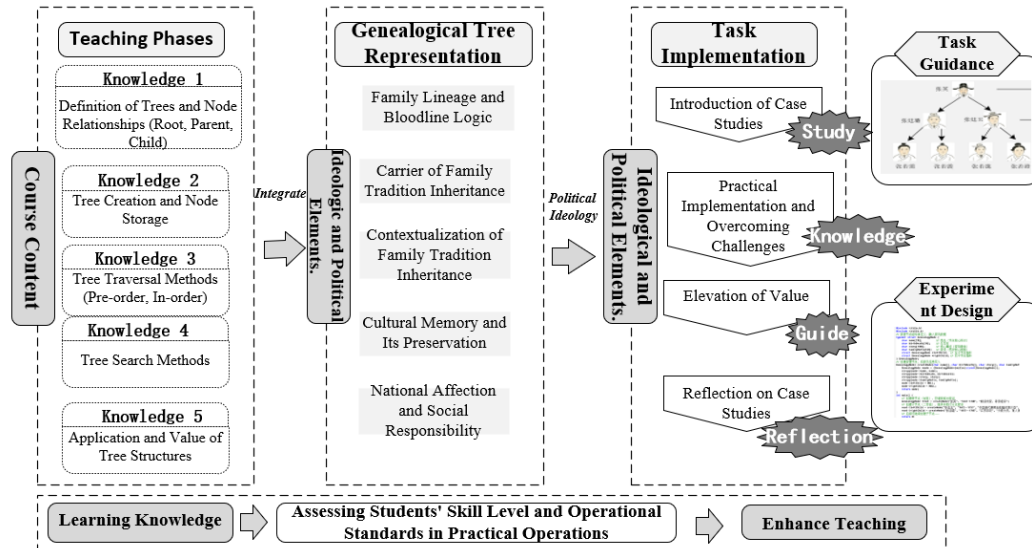


Figure 1. Ideological and Political Education Integration Framework

1) Core Knowledge Points of Tree Structures: A tree is a typical nonlinear structure in data structures, distinct from linear structures such as arrays and linked lists that have a "one-to-one" relationship. Trees organize data through a "one-to-many" hierarchical relationship. The core knowledge points of tree structures can be summarized as three elements: "definition — composition — characteristics," laying the theoretical foundation for the subsequent application of the family tree.

(1) Core Definition: A tree is a finite set of n ($n \geq 0$) nodes. When $n = 0$, it is called an empty tree. When $n \geq 1$, there exists a unique node called the "root," and the remaining nodes can be divided into m ($m \geq 0$) disjoint finite sets. Each of these sets is itself a tree, known as the "subtree" of the root node.

(2) Key Composition: The basic unit of a tree is a node, and the relationships between nodes form the tree's structure. Key concepts include: root node, parent node, child node, leaf node, sibling node, subtree, depth, etc.

(3) Core Characteristics:

The root node is unique, and the entire tree is governed by the root node.

Subtrees are disjoint to prevent data association confusion.

Every node, except the root node, has exactly one parent node, ensuring a clear hierarchical structure.

There is a unique path between any two nodes in the tree, from the root node to any other node, ensuring determinacy in data queries.

2) Layered Design: Adapting Tasks for Basic and Advanced Students: Considering the ability differences among second-year undergraduate computer science students — where basic students have mastered programming syntax but have a shallow understanding of nonlinear structures, and advanced students are capable of flexibly applying recursive thinking to solve problems — the tasks are designed in a "basic-level — advanced-level" layered manner. All tasks are framed using the "family tree" as a cultural medium to simultaneously integrate knowledge and values[4].

(1) Basic Students: Focus on "Concept Correspondence + Simple Applications": Core Objective: Master the basic concepts of trees and establish a direct correlation between family genealogy and tree structures, completing simple node definitions and associations.

Concept Mapping Task: Provide a simplified version of the "Zhang Family Genealogy" with key

information and have students manually draw the corresponding diagram of "family tree — data structure tree," labeling relationships such as root node, parent node, child node, etc. This helps them understand the connections between "family generation = tree depth" and "branch = subtree" through the drawing.

Code Practice Task: Define the "family tree node" based on a structure, including core data fields such as name and birth/death years, as well as pointers to left and right child nodes (simplified using a binary tree structure). Using the example code, students will complete the creation and association of the root node and first-level child nodes, achieving the goal of "building the basic framework of a family using code."

(2) **Advanced Students:** Focus on "Application of Characteristics + Logical Deepening": **Core Objective:** Apply the recursive and structural characteristics of trees to implement complex associations and preliminary traversal of family trees, and understand the advantages of tree structures in cultural data storage.

Application of Characteristics Task: Based on the node definitions from the basic tasks, add data fields such as "family instructions" and "key deeds." Students are required to use recursive thinking to write a function for "batch creation of child nodes" — input a parent node and a list of information about that node's descendants, automatically creating and associating all child nodes. Students are also asked to think about "why is the tree structure suitable for storing genealogies?" They should summarize how the tree's "clear hierarchy and unique associations" align with the genealogy's "distinct generations and unique bloodlines."

Expansion Thinking Task: Analyze the issue of "pest damage causing loss of information in a family branch" in paper genealogies. Using the tree's "independent subtrees" feature, propose a "subtree backup" solution — dividing the Zhang family genealogy into multiple subtrees based on branches, where damage to one subtree does not affect the others. This allows students to appreciate the advantages of tree structures in data fault tolerance while connecting the concept of "family branches being independent but part of a whole" with cultural connotations.

At the beginning of teaching the "tree" knowledge point, the question "Why is the tree in data structures referred to as the 'core of nonlinear structures'?" is posed to stimulate thought. The definition of trees is explained through the "file system directory" case: consisting of root, parent, child, and leaf nodes, with characteristics of "unique root, clear hierarchy, and distinct branches." Once students grasp the basic concepts, the focus shifts to the cultural context: "In traditional Chinese culture, there is a medium that aligns closely with the tree structure, which records the continuation of family bloodlines — the family genealogy."

A comparison slide of the replica of the Qing Dynasty "Zhang Family Genealogy" and the tree structure diagram (Figure 1) is shown to visually establish the conceptual link.

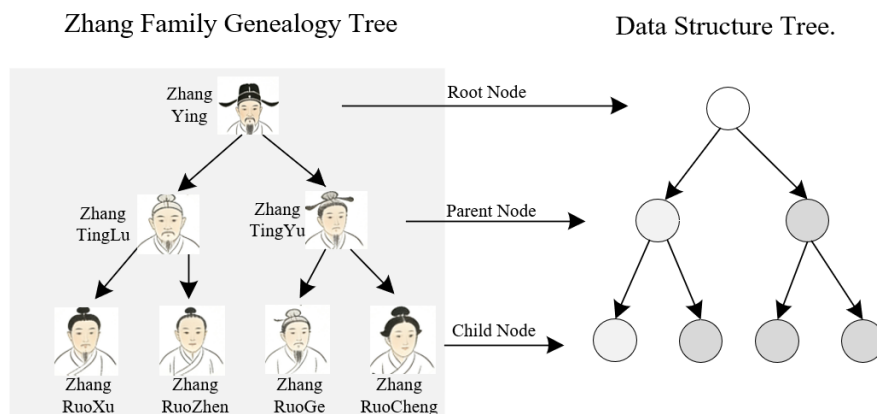


Figure 2. Correspondence Between the Zhang Family Genealogy and Tree Structure

The teacher guides students to match each element one by one: the ancestral progenitor of the family → root node, ancestors → parent nodes, descendants → child nodes, those with no heirs → leaf nodes,

a particular branch → subtree, "generational levels" correspond to the "depth" of the tree, and "population of a branch" corresponds to the "number of nodes" in the tree. It is particularly emphasized that the distinction between a family tree and a regular tree structure lies in the "cultural genes" — each "node" is not only a symbol of a name but also a carrier of family values; each "branch" is not only a continuation of the bloodline but also an extension of the root lineage. For example, in the Zhang Family Genealogy, "Zhang Tingyu inherited Zhang Ying's 'Six-Foot Alley' frugal family values. As a prominent official during the Kangxi, Yongzheng, and Qianlong reigns, the only Han official to be honored at the Temple of Ancestors, Zhang served as a minister for fifty years with diligence, integrity, and a commitment to public service, becoming a model of family values and loyalty to the nation." This helps students initially understand: the "relational" characteristic of the tree structure, in the cultural context, represents the generational transmission of family spirit.

4.2 Practical Challenge: Tree Structure Operations and Family Values Excavation Based on the Family Tree.

This section focuses on the practical task of "building the Zhang Family Genealogy Digital System," deeply integrating operations such as tree creation, traversal, and searching with the stories of family traditions. The teaching progresses in three steps.

Tree Creation: Using Code to Capture the Family's Root Lineage

Provide core data for the Zhang Family Genealogy: Zhang Ying (1637 - 1708, a famous scholar during the Qing Dynasty, Grand Secretary of the Wenhua Hall, known for the family tradition of farming and studying, and filial piety and harmony with neighbors), Zhang Tingyu (1672 - 1755, a minister during the Qing Dynasty under the Kangxi to Qianlong reigns, focused on benefiting the people and refraining from personal gain), Zhang Tinglu (1655 - 1702, an academic official in Jiangsu), Zhang Ruocheng (1722 - 1770, a court painter during the Qing Dynasty), and others. Guide students to think about how to store multidimensional information such as "name, birth and death years, deeds, family instructions" using code.

Using the knowledge of structures, define the "family tree node" structure, which includes fields for name, birth and death years, key deeds, family instructions, and pointer fields for left and right child nodes (using a binary tree for simplified storage). An example code is as follows:

```
#include <stdio.h>
#include <stdlib.h>
// 家谱节点结构体定义, 融入家风数据
typedef struct GenealogyNode {
    char name[20]; // 姓名 (节点核心标识)
    char birthDeath[20]; // 生卒年
    char story[100]; // 核心事迹 (家风载体)
    char familyMotto[50]; // 家训 (思政核心数据)
    struct GenealogyNode *leftChild; // 左子节点指针
    struct GenealogyNode *rightChild; // 右子节点指针
} GenealogyNode;
// 创建家谱节点, 将家风信息写入
GenealogyNode* createNode(char name[], char birthDeath[], char story[], char familyMotto[]) {
    GenealogyNode *node = (GenealogyNode*)malloc(sizeof(GenealogyNode));
    strcpy(node->name, name);
    strcpy(node->birthDeath, birthDeath);
    strcpy(node->story, story);
    strcpy(node->familyMotto, familyMotto);
    node->leftChild = NULL;
    node->rightChild = NULL;
    return node;
}
int main() {
    // 创建根节点 (始祖), 存储家族总家训
    GenealogyNode *root = createNode("张英", "1637-1708", "耕读传家, 孝亲睦邻");
    // 创建子节点 (二世祖), 继承并践行分支家训
    root->leftChild = createNode("张廷玉", "1672-1755", "中国清代康熙至乾隆时期大臣", "利民为本, 不谋私利");
    root->rightChild = createNode("张廷璐", "1655-1702", "江苏学政", "兴教为先, 育人育德");
    // 后续可继续创建子节点...
    return 0;
}
```

Figure 3. Family Tree Construction Code

Create a node for Zhang Ying as the root node using dynamic memory allocation, and then sequentially associate child nodes such as Zhang Tingyu, Zhang Tinglu, etc. In the code comments, specifically highlight: "The root node stores the family's 'farming and studying as a family tradition'

core family instruction, while the child nodes inherit and practice the branch family instructions." This allows students to understand the "irreplaceability of the family's root lineage" through the process of writing the code.

1) Tree Traversal: Using Algorithms to Trace Family Tradition Inheritance: Present the task: "How can we fully present the lineage of the Zhang family's family tradition according to generational order?" Introduce the three tree traversal methods, with a focus on pre-order traversal (root → left subtree → right subtree), which corresponds to the family tradition of "respecting ancestors and elders, first recording the ancestral family instructions, and then describing the practices of the branches." Demonstrate the traversal process and visualize it (Figure 4).

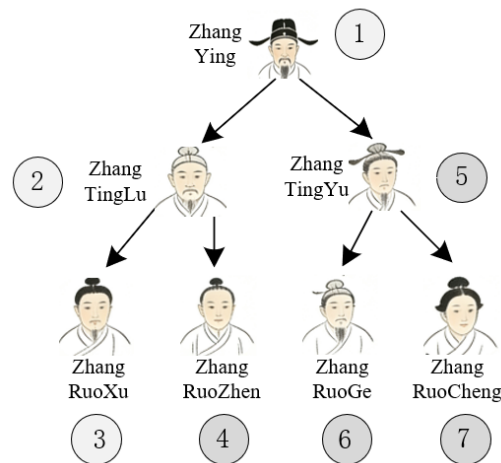


Figure 4. Pre-order Traversal Sequence of the Zhang Family Genealogy Tree

Based on the structure of the "Zhang Family Genealogy Tree," the pre-order traversal sequence is as follows:

Root node: Zhang Ying

Left subtree (Zhang Ying's left child branch):

Parent node: Zhang Tinglu

Zhang Tinglu's child nodes (left → right): Zhang Ruoxu, Zhang RuoZhen

Right subtree (Zhang Ying's right child branch):

Parent node: Zhang Tingyu

Zhang Tingyu's child nodes (left → right): Zhang Ruo'ai, Zhang Ruocheng

Final pre-order traversal sequence: Zhang Ying → Zhang Tinglu → Zhang Ruoxu → Zhang RuoZhen → Zhang Tingyu → Zhang Ruo'ai → Zhang Ruocheng

Simultaneously, display the recursive implementation code, with key steps marked with ideological and political education (IPE) connections.

```
// 先序遍历家谱树，输出家风传承
void preOrderTraversal(GenealogyNode *node) {
    if (node != NULL) {
        // 访问节点：输出成员信息与家训（核心：呈现家风）
        printf("姓名： %s， 生卒： %s， 事迹： %s， 家训： %s\n",
            node->name, node->birthDeath, node->story, node->familyMotto);
        preOrderTraversal(node->leftChild); // 递归遍历左子树（支系传承）
        preOrderTraversal(node->rightChild); // 递归遍历右子树（支系传承）
    }
}
```

Figure 5. Recursive Implementation Code

Expansion Task: Have students use in-order traversal to count the number of "family members who practice the 'teach and promote education' family instruction." In the process, students will experience that algorithms are not only technical tools but also "digital brushes" for organizing cultural lineages.

2) Tree Search: Using Technology to Revive Family Memories: Set the scenario: "Descendants of the Zhang family want to learn the specific details of 'Zhang Tingyu's life deeds.' How can they quickly locate this information in the family tree?" Introduce the tree search algorithm, using "Zhang Tingyu" as the target node. Employ the binary search tree method, and visualize the search process as follows.

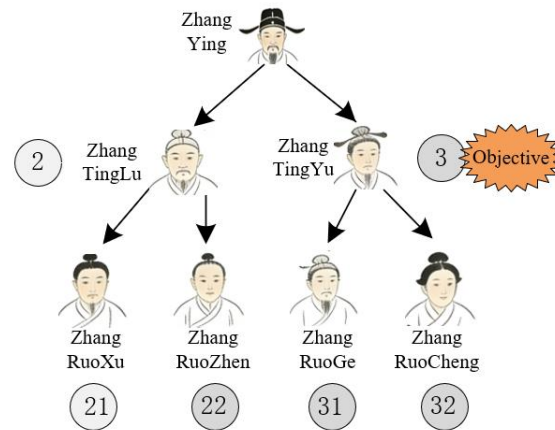


Figure 6. Search Process Flowchart of the Zhang Family Genealogy Tree

The complete search process follows the "compare parent node → left smaller, right larger → recursive search" rule.

Initial State: The search pointer points to the root node "Zhang Ying." The target key value = Since Zhang Ying does not have a direct key value, it directly accesses its left and right child nodes. The first comparison shows that Zhang Ying's left child node is Zhang Tinglu (key value = 2), and the right child node is Zhang Tingyu (key value = 3).

Since the target key value 3 - the left child node's key value 2, according to the rule "right subtree node value - parent node's associated child node value," we skip the left subtree and move on to the right child node.

Match Found: Access Zhang Ying's right child node, which has a key value of 3, matching the target key value exactly. It is confirmed that this node is "Zhang Tingyu," and the search ends.

Result Output: The node for Zhang Tingyu is located, and we can directly retrieve his associated "life deeds" (inheritor of the 'Six-Foot Alley' family values, a prominent minister during the Kangxi, Yongzheng, and Qianlong reigns, the only Han official to be honored at the Temple of Ancestors, serving diligently and with integrity for fifty years).

Ideological and Political Education Connection: The "ordered branches" of the family tree correspond to the family's "order of generations, orderly transmission of family values," while the tree search algorithm is the technical application of the "ordered structure" — from "orderly inheritance" in culture to "efficient search" in technology, reflecting the core logic of "structure determines function." "This section of the story is unclear in the paper genealogy due to pest damage, but through the digital family tree's node storage and precise search, the family tradition story becomes clear again."

Guide students to appreciate the "protective role of technology in cultural inheritance" — the tree search algorithm is essentially a "technical means of reviving family memories and continuing family traditions."

4.3 Value Enhancement: From Family Tradition Inheritance to a Cognitive Leap Towards Family and Nation Unity.

This section uses the structural characteristics of the Tongcheng Zhang Family Genealogy Tree as a starting point, linking the logical chain of "family values — family — nation." It guides students to achieve a cognitive leap from "understanding technical knowledge" to "recognizing ideological and political values," helping them deeply appreciate the Confucian ideal of "cultivating oneself,

managing the family, governing the nation, and bringing peace to the world," as well as the contemporary mission of young people.

From "Tree Structure Stability" to "The Foundational Role of Family Tradition Inheritance"

Connection Between Technology and Culture: review the structure of the Zhang Family Genealogy Tree: The root node Zhang Ying represents the family values of "humility, courtesy, integrity, and self-restraint" from the "Six-Foot Alley" tradition, which forms the "root foundation" of the tree. This then branches out into parent nodes like Zhang Tingyu and Zhang Tinglu, which further extend to child nodes like Zhang Ruo' ai and Zhang Ruoxu. This structure aligns closely with the "stability of the tree" in data structures — the properties of the root node determine the growth direction of the entire tree, just as the core of family tradition shapes the trajectory of the family's development. The family instructions of "integrity, diligence, and caution" established by Zhang Ying serve as the "roots" of the tree, providing spiritual nourishment for family members. Meanwhile, the "one father, many children" branching characteristic represents the tangible, generational transmission of family values.

Student Reflection: Why has the Zhang family survived and thrived through three generations of the Kangxi, Yongzheng, and Qianlong reigns? The core reason is that family tradition is not an empty slogan, but a code of conduct ingrained in the bloodline. Zhang Tingyu inherited this tradition and served as a minister for fifty years with "integrity, public service, diligence, and practicality," becoming the only Han official in the Qing Dynasty to be honored at the Temple of Ancestors. This is a vivid example of how "good family values nurture good talent." For individuals, family tradition is a "compass" for growth; for society, it is the "cornerstone" of harmony.

From "Family Branch Development" to "The Synergistic Effect of Family and Nation Unity"

Connection Between Technology and History

The "branch extension" of the Zhang Family Genealogy Tree is not only the inheritance of bloodlines but also a deep connection between family and national development. Take the "Zhang Tingyu branch" as an example: As an important "parent node" of the family tree, his life trajectory aligns with the flourishing of the Qing Dynasty during the Kangxi, Yongzheng, and Qianlong reigns — Assisted Kangxi in pacifying the three feudal lords and managing the Yellow River, laying the foundation for the "prosperous era."

Assisted Yongzheng in perfecting the military mechanism and implementing the land tax reform, pushing for "deeper reforms."

Assisted Qianlong in stabilizing the central administrative system, ensuring the "continuation of the prosperous era."

This process mirrors the "upward growth of branches" in a tree. Every step of the family's development is closely aligned with the needs of the nation at that time, and the prosperity of the nation provides a broad platform for the family's growth.

Student Discussion: Is the Zhang family's glory the result of personal effort, or the gift of historical opportunities? The conclusion is that both factors complement each other. Without the foundation of the "Six-Foot Alley" family values, Zhang Tingyu would not have become a "three-reign minister." Without the era of national unity and social stability, the family's cultural and political ambitions would have had no outlet. From this, the core idea emerges: "The family is the smallest nation, and the nation is made up of countless families." The fate of the family is always closely connected to the fate of the nation. A person's ideals can only truly be realized when they align with the development of the nation.

From "The Tree's Endless Growth" to "The Mission and Responsibility of Contemporary Youth"

1) Connection Between Technology and Reality: in data structures, the vitality of a tree lies in the "unchanging roots, ever-growing branches." The roots are the soul of the tree, while the branches are its future. Similarly, the vitality of Chinese culture lies in "the unchanging traditional roots, with constant innovation for the times." The Zhang Family Genealogy Tree has been passed down to this day, with its root values of "humility, courtesy, integrity, and public service" never changing, while the family members' missions have evolved with the times: ancient members focused on "assisting in governing the country," while contemporary members aim for "strengthening the country through

technology and cultural prosperity." This is the practical embodiment of the tree's "endless growth" characteristic.

2) Further Guidance: "As computer science students, what is the significance of building a family tree?" The clear answer is: it is not only about mastering tree structure knowledge, but also about using technology to safeguard cultural roots — ensuring the transmission of family values does not "disconnect" through digital means, allowing more people to draw spiritual strength from the family tree. At the same time, students must understand that the value of professional skills ultimately lies in "serving the nation and contributing to society": optimizing government systems using algorithms to improve efficiency, constructing cultural heritage databases using data structures — these are concrete practices of "family and nation unity."

5. Case Closure: Achieving Dual Objectives and Reflection

This case study achieves the dual integration of professional knowledge and ideological and political values through the cultural medium of the "family tree." From the professional perspective, students mastered core operations such as tree creation, traversal, and search through system development, enabling them to convert abstract concepts into the ability to solve practical problems. From the ideological perspective, students understood the cultural significance of "root lineage inheritance" through the family tradition stories in the genealogy, establishing a sense of responsibility for "technology serving society"[5][6].

Using the "ultimate educational goal" shown in the diagram as the anchor, the design progresses through "knowledge consolidation, value internalization, and action extension," creating a deep loop that connects technical knowledge, ideological values, and student practice, allowing the teaching process to move from "understanding" to "practice."

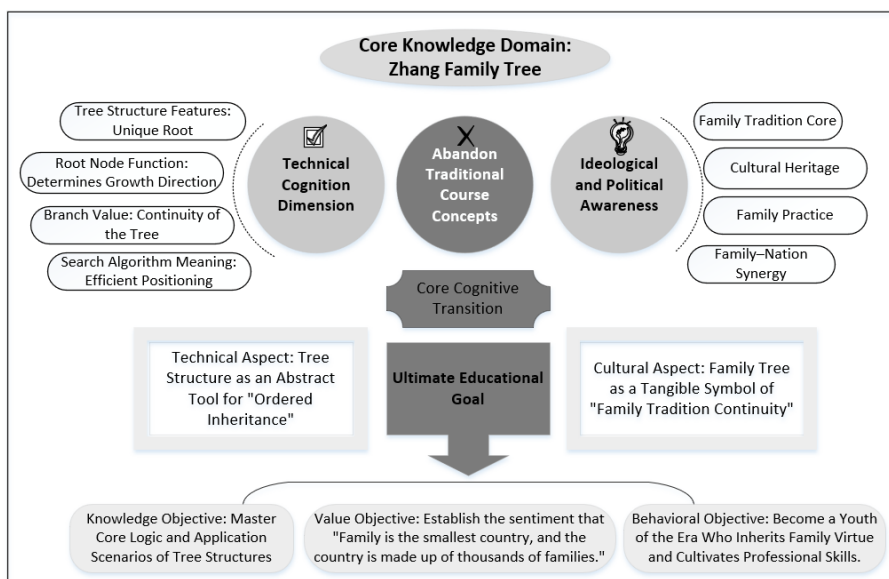


Figure 7. Case Closure Diagram

5.1 Knowledge Objective Implementation: Precise Internalization of Technical Logic.

Focusing on the "Technical Cognition Dimension" knowledge points in the diagram, using the "Zhang Family Genealogy Tree" as a medium, we solidify the core concepts of tree structures through "case correspondence + practical validation".

Knowledge Anchoring: Guide students to match the key points of the "Technical Cognition Dimension" in the diagram with specific nodes in the Zhang Family Genealogy Tree — for example, the "unique root of the tree" corresponds to Zhang Ying, the "role of the root node" corresponds to the direction of family values set by Zhang Ying, and the "branch value" corresponds to the family continuation represented by nodes like Zhang Tingyu.

Practical Validation: Set the task of "finding Zhang Tingyu" and have students, based on the "search algorithm significance" in the diagram, independently complete the binary search tree search deduction. This allows them to verify their grasp of the "efficient location logic" of tree structures, ultimately achieving the knowledge objective of "mastering the core logic and application scenarios of tree structures."

5.2 Value Objective Implementation: Emotional Resonance of Family and National Affection.

Based on the "Ideological Cognition Dimension" and "Core Cognitive Leap" logic in the diagram, achieve value recognition through "case empathy + discussion elevation":

Case Empathy: Combining the key points of "family values core" and "family practice" in the diagram, use "Zhang Ying giving up land in 'Six-Foot Alley'" and "Zhang Tingyu assisting in governance through three reigns" as entry points to guide students to reflect on, "If you were a descendant of the Zhang family, how would you inherit such family values?" This helps establish an emotional connection to "how family values shape the family."

Discussion Elevation: Focus on the "family-nation linkage" logic in the diagram and organize a discussion on "How can small family values serve the development of the larger society?" Students can reflect on their own family cases and understand the relationship between "the family is the smallest nation, and the nation is made up of countless families," ultimately establishing the value objective of family and national affection.

5.3 Action Objective Implementation: The Practice Extension of Unity of Knowledge and Action.

Through the previous cognitive connections and leaps, three main objectives are achieved:

- 1) Knowledge Objective: Master the core logic and applications of tree structures (technical knowledge implementation).
- 2) Value Objective: Establish the value of "the family is the smallest nation, and the nation is made up of countless families" (ideological and political values implementation).
- 3) Action Objective: Become a young person of the era who "inherits family virtues + improves professional skills" (practical implementation of knowledge and values). Guided by the "Action Objective" in the diagram, a "classroom and extracurricular linkage" practical task is designed to transform cognition into specific actions.
- 4) Practical Task: Imitate the "Zhang Family Genealogy Tree" framework diagram and have students create a "self-family - society" relationship diagram, marking the correspondence between "family values core," "personal growth," and "social value," completing the visualization of "family tradition inheritance."

Extracurricular Extension: Assign the "Double Practice" task — Inheriting Family Values: Do something small that reflects your family's values (e.g., practicing "humility" by proactively resolving a minor interpersonal conflict).

Improving Skills: Use the logic of tree structures to organize professional notes (taking "core knowledge points" as root nodes and extending branch knowledge points), achieving the "inherit family values + improve professional skills" action objective.

Through this loop, students will not only master technical knowledge of tree structures but also internalize the ideological values of family and national affection, ultimately transforming into "unity of knowledge and action" in practical endeavors, fulfilling the teaching goals.

5.4 Teaching Reflection: Successes and Challenges of Case Integration.

In implementing the case, two "balances" must be considered: First, the balance between technical depth and cultural richness, avoiding the weakening of algorithmic logic by overemphasizing cultural aspects. Second, the balance between teacher guidance and student active reflection, transforming students from "passively receiving" to "actively identifying" through group discussions and story sharing. Future improvements include precisely adjusting the tree structure's key value rules to better suit student needs by replacing "age order" with "family generations" to make the search algorithm more aligned with students' understanding of family relationships. Additionally, incorporating "modern family tradition cases" (such as academic families, artisan families) will help students better connect with their own lives, increasing participation in practical tasks.

In the "Core Cognitive Leap" section in the diagram, an interactive module for students' independent thinking (e.g., "What other cultural carriers can be mapped to tree structures?") should be added to strengthen the proactive nature of the dual integration, further deepening the recognition of "the nation is the collection of many families," and enhancing the theme of "strengthening the soul of the nation."

6. Conclusion

The "Zhang Family Genealogy Tree" teaching case uses the "tree" from data structures as the technical medium, with the family tradition inheritance of the Tongcheng Zhang family as the cultural core, creating a complete chain of "technical cognition — ideological and political values — practical action." From the positioning of the "core link" in the diagram, to the interlocking of the "dual cognition," and finally to the implementation of the "goal closure," this is essentially a teaching practice of "using trees as a medium to cultivate culture" — not only allowing students to master the technical logic of tree structures, but also integrating the family and national affection of "the family is the smallest nation, and the nation is made up of countless families," which is truly brought into the classroom and integrated into students' cognition through the tangible medium of the family tree. While there is still room for optimization in the details of the design, the core value of this case lies in proving that the integration of ideological and political education into technical courses is not an addition of "knowledge + slogans," but a symbiosis of "medium + core." When technical knowledge and cultural spirit find a natural connection, teaching can achieve the unity of "teaching, spreading the Dao, and solving doubts," enabling students to not only master skills but also grow into young people with warmth and responsibility in the new era.

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