Development Strategy of Steam Educational Books Subject Selection Based on SECI Model

Jingwen, Lai

College of Communication and Art Design, University of Shanghai for Science and Technology. Shanghai, China

Abstract: *Based on the SECI model of knowledge management, this paper establishes the process of transferring tacit knowledge into explicit knowledge for STEAM educational books, and guides the editors to pay attention to the four stages of knowledge management in the development of book topics. This paper puts forward some suggestions on how to strengthen the representation ability of STEAM tacit knowledge, integrate internal and external resources by knowledge sharing, and optimize the development of explicit knowledge in popular science education. To help relevant industry personnel according to the actual needs, flexible use of knowledge management concept to grasp the depth of STEAM educational books planning, to promote related inter-disciplinary popular science books and knowledge re-dissemination of in-depth application.*

Keywords: book publishing; knowledge management; STEAM; subject selection planning

1. Introduction

The publication of popular science education is changing the training mode of People's learning and creative thinking ability, and the topic of popular science and scientific quality construction is becoming more and more prominent in the policy outline. The outline of the Action Plan for the quality of science for all (2021-2035), issued by the 2021 on June 3, aims to improve the quality of science for all and provide highquality development services for all, science education is being reintegrated into the basic education. As an important spiritual and cultural product, the selection and publication of STEAM educational books conform to the trend and can enrich the publishing resources of popular science books for children in terms of culture and education, effectively make up for the shortage of basic reading materials for popular science. The knowledge management model under the management science, taking the reinnovation of the tacit knowledge and the explicit knowledge as the core elements, can provide the reference for the development and transformation of the topic selection of the transdisciplinary popular science books, therefore, this paper will transfer the SECI model under the concept of knowledge management and combine it with the development of book topics, in order to promote the development of scientific, efficient and high quality popular science books.

1.1 The core connotation of steam educational books

The essence of STEAM was first derived from the English acronym STEM, the interdisciplinary integration of science, technology, engineering and mathematics. But Professor Yackman argues that art is far more than aesthetics, encompassing a range of humanities and arts disciplines linked by cross disciplines, therefore "STEAM" from the original "STEM" added to the humanities and arts disciplines [1]. Therefore, the nature of STEAM educational books in this paper is carried out with books as carriers, the knowledge dissemination carrier and behavior of science, technology, engineering, arts and Humanities, Mathematics, science and Technology Knowledge and science spirit. In addition, STEAM education was first proposed on the basis of the real situation in order to develop students'ability to cope with changes and solve social problems, so STEAM educational books are mainly aimed at the primary and secondary school students.

Most of the existing academic research tends to the advantage of the integration of the interdisciplinary knowledge of STEAM, but the methods and methods of the management and development of the specific titles of STEAM books still need to be clarified. Liu Xiaoye and others found in the scientific issues raised by young children that it has four typical educational concepts: situational, interdisciplinary, subjective and experiential [2]. That is to say, the setting of the content of STEAM popular science publications should be based on the problem solving of the real situation to arouse the enthusiasm and initiative of students' Autonomous Learning. Peng Min and others believe that its basic connotation is mainly embodied in the solution of real problems, discipline integration and skills training. This means that the publication of similar books should be carried out around these three aspects of book planning and content redesign [3]. Wei Xiaodong and others link multiple disciplines in an integrated way, encouraging students to explore and emphasize the interconnections between knowledge and the real world [4]. This research also provides a new direction and thought for the publishing of STEAM educational books, that is, the internalization and absorption of knowledge of student readers should be taken as the overall value orientation of books, this is the starting point for knowledge development and management.

To sum up, this research thinks that STEAM educational book publishing should have the following four core connotation characteristics: (1) strengthen the integration of interdisciplinary educational knowledge. (2) the setting of the content of the publication should be based on the

problem solving of the real situation. (3) to emphasize the scientificity and accuracy of the five disciplines of "STEAM". (4) STEAM education publishing should focus on the basic concepts and knowledge system of the discipline itself. Based on the above connotative features, this paper constructs a framework for the development of titles of STEAM educational books, that is, it needs to set up four dimensions from the systematicness, scientificity, integration degree and situation of subject knowledge.

1.2 The application of SECI model theory in the development of STEAM books subject selection

The SECI model was developed by Ikujirononaka and Hirotakatakeuchi in their book, Innovation for Success, by studying the collective knowledge transfer processes of firms, it is revealed that the mutual transformation of "tacit knowledge" and "explicit knowledge" is a developing model which is rising continuously and iteratively [5]. SECI put forward the innovation stage of knowledge management development, and described the whole process of knowledge transformation from individual tacit knowledge to collective innovation wisdom. The first premise points out that both the process of knowledge innovation and the process of individual learning and growth need to be in social group interaction activities to complete and achieve. According to SECI model, the process of knowledge transformation includes four links: socialization, externalization, connection and internalization. The communication between individuals in the process of socialization is the beginning of knowledge transformation, individuals gather together to produce knowledge interaction, and knowledge is transformed from recessive to dominant; in the process of association, dominant knowledge is integrated and processed into an orderly dominant knowledge set; in the process of internalization, it is the individual who gains new tacit knowledge after comprehending the explicit knowledge set.

The development of topic selection of educational books is an activity of knowledge creation and collection, while the development of topic selection of educational books for popularization of science based on STEAM has the characteristics of knowledge experience and knowledge organization, in addition, the agents involved in the exploration of unknown process are uncontrollable and uncertain behavior, so there are many uncertain factors (Tab 1). It can be broadly divided into three roles: a project sponsor (which can be an organization such as a government or school), a book developer and a project gatekeeper, with the final interpretation rights and intellectual property rights of the book project; the Second Project Executive (which may be the publishing organization team, the intellectual product manager, etc.) shall be responsible for the planning, production and organization of the whole book project, and for the requirements of the demand side and its own publishing expertise for planning and development; The third is a third party of participants (who may participate as educators and professionals in the STEAM field), which may appear

either as a separate author resource for the Implementing Party or as a collaborative force dispatched by the initiators, it plays the role of providing content and layout design for some of the professional areas of the book project.

Table 1: SECI knowledge spiral chart in the development of STEAM educational books

	Tacit Knowledge	Explicit knowledge
Tacit Knowledge	S: Social Participant role: Sponsor + Executor + third party	E: externalization Participant role: Executor
Explicit knowledge	I: Internalization Participant role: Sponsor + Executor + third party	C: Connectedness Participant role: Executor + Third Party

The tripartite role as the main body of the development process of interdisciplinary popular science books will run through all the time, so this paper proposes to transfer and construct the innovation of STEAM Educational Books Development Management under the SECI model. As shown in Figure 2, socialization has successfully transformed individual tacit knowledge into group tacit knowledge sharing through topic selection design, workshops on works and authors, and implementation workshops on related manuscript topics, in this process, all three parties are involved, externalization is mainly represented and determined by the content and form of STEAM subject selection, which is accomplished by the executive alone The integration and sharing of topics and group knowledge are carried out by the executive and the third party, while the internalization covers the topics of the three parties and optimizes the topic selection throughout the development process of STEAM, the combing of inclusive information and the innovation of new invisible knowledge.

1.3 Problems of knowledge management in the development of STEAM educational books

The development of STEAM books is a complex systems engineering, including but not limited to knowledge acquisition, knowledge storage, knowledge representation, knowledge sharing and knowledge innovation. Educational books can be the works of collectives or individual authors, but the cross disciplinary popular science educational books play a more significant role in the comprehensive cultural output of science, education and society, the proposition of the title of the book, the selection and optimization of the content cannot be accomplished by an individual or a nonprofessional group alone, and the transformation of these tacit and explicit knowledge must be accomplished by a professional team together, however, it is impossible for every participant to have a good knowledge of interdisciplinary science popularization and the business of publishing and selecting topics at the same time, so many problems need to be solved in this process, through investigation and observation, the following contradictions are found to be more prominent.

The way of knowledge representation can not arouse the reader's interest. How to correctly and effectively represent the rigorous knowledge of STEAM to arouse the reader's interest and improve the reader's scientific innovation ability is the place that the three parties of book development need to pay attention to. Readers with interest and learning needs have different information characteristics in acquiring and receiving knowledge, so we should choose the form and content of popular science books to treat this problem differently.

Insufficient knowledge of interdisciplinary development decision making. The development of STEAM books has the typical characteristics of transdisciplinary knowledge dissemination and publishing, in addition, the whole process of development decision making is also a process of knowledge enrichment, this means that each phase and each unilateral organization will complement each other with new knowledge, which will also create new requirements for the implementers of the development of STEAM educational books.

There is a deviation in the process of editors absorbing their own knowledge. Individual editors can only acquire and produce knowledge in the field of publishing, while the internalization of STEAM knowledge needs to be absorbed and translated into the productivity of book editors in the development of STEAM books, this knowledge spiral from individual to organization and then to individual is prone to knowledge transfer deviation.

The idea of knowledge management has not been applied throughout the development of books. There is a lack of consideration and sharing between the book publishing project and the tripartite cooperation in STEAM topic selection and book development practice, that is to say, there is no planning and development from the height of knowledge management, to a certain extent, this reflects that the application of knowledge product project management concept in the field of publishing has not been normalized.

1.4 The design of knowledge transformation in the development of STEAM educational books

The knowledge transformation in the development of STEAM educational books is an important stage of knowledge construction. The application of learning space in educational books needs to pay attention to the design of knowledge innovation and knowledge ability transformation, and grasp the key points of book planning. The consistency of SECI model and process is reflected in the knowledge construction of STEAM educational books, that is, covering and embodying four conversion modes (as shown in Figure 1) [6].
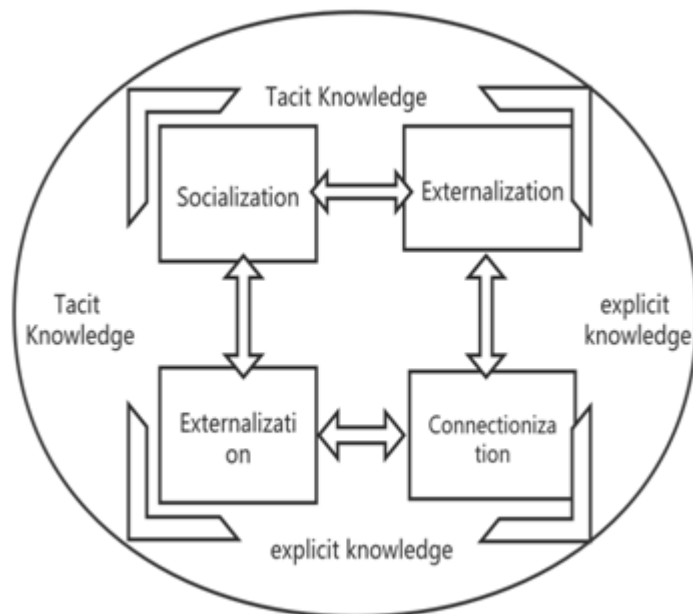

Figure 1: SECI matrix

1.4.1"socialization (tacit knowledge → tacit knowledge) phase"
This stage is the process of learning, exchanging and imparting between the individual knowledge and the group knowledge, popularizing and applying the habitual experience. In the development of specific STEAM educational books, in the process of developing STEAM books, socialization imparts knowledge and solves problems through the form of social externalization and

communication. Only when people with knowledge can solve practical problems together, this is the socialization of knowledge, so knowledge externalization and problem solving are linked together. For example, to transform the application of STEAM scientific knowledge under the SECI model of knowledge management, including the development of different online and offline knowledge exchange seminars, the popularization of science experiments, teaching or practice of STEAM books, etc., as

well as the author and the third party authority person's related teaching and the experience through the book form, once again transforms the tacit knowledge experience, applies to the book executive side publishing team, becomes the new tacit knowledge.

1.4.2"externalization (tacit knowledge → explicit knowledge) stage"

This stage is the process in which the individual manifests his or her own knowhow, feelings, and experiences by means of written symbols. Writing and extracting the contents of STEAM educational books is a process of transforming tacit knowledge into explicit knowledge, and is a form of outward representation and secondary sublimation of popular science knowledge. Among them, the professional knowledge, which is gradually formed by book authors and editors according to their own practical work and study experience, and which has practical guiding significance for education and teaching, belongs to tacit knowledge, and this kind of knowledge has habit commonly, even some become own knowhow and style, not easy for others to grasp and know, need to carry on the transmission of knowledge through external representation [7]. At present, the vast majority of publishers choose popular science authors who are already well known, making use of their rich creative background and skillful writing skills, and on the basis of their editing and planning experience, the innovation and integration of language and writing can produce new explicit knowledge to spread children's popular science knowledge.

1.4.3"stage of connectedness (explicit knowledge → explicit knowledge)"

This stage is the process of knowledge reconstruction, integration, sharing and innovation at the organizational level and the realization of knowledge value added [8]. STEAM the development of explicit knowledge of science requires ensuring that the knowledge material provided is validated, mature, and targeted. In order to achieve this goal, it is necessary to strengthen communication and exchange among the participants in order to realize the best adaptation of the existing knowledge representation ability and the popular science knowledge with the project needs, to develop more targeted and educational books. After the first draft of the new explicit knowledge for science popularization came into being, all parties involved in the STEAM publishing project began to play their roles as a group. Under the guidance of the project review system and the post responsibility system, the implementing party exchanges the contents and knowledge of the existing STEAM popular science manuscripts among the participating parties, shares and reproduces them, and develops the business of the popular science books project around the core position and value of editing, this is the basis and focus of STEAM educational books under the SECI model of knowledge management.

1.4.4"stage of internalization (explicit knowledge → Tacit Knowledge) "

This stage is to digest and absorb the experience and

knowhow of the organization level consensus into the individual knowledge structure system, forming knowledge, habits, rules and ideas. It is also the result of the application of STEAM popular science knowledge, the main body of which is the executive publishing team. For example, the STEAM educational book product, which brings together interdisciplinary wisdom, is the result of the application of knowledge, in which the implementation of the book project takes place in the context of full interaction and learning with the various participants, continuously assimilating and absorbing tacit experience, collective knowledge and skills into individual knowledge structure system and forming individual or collective knowledge, habits, norms and thoughts, etc., and for the implementation of the team after the development of STEAM popular science books to form a complete knowledge management process chain, but also for the product to build a solid foundation.

2. Development strategy of STEAM educational books based on SECI model

2.1 strengthening the representation ability of tacit knowledge by using the potential under the background of popular science

Under the environment of popular science, the development of popular science books is an important link and material carrier foundation to complete the outline of the action plan for the scientific literacy of the whole people (2021-2035), we should make good use of the potential energy and internal logic of popular science publishing to innovate the publishing representation paradigm of popular science education. In the past, popular science books such as the Encyclopedia of China's children and adolescents and the 100, 000 Whys have played an important role in the development of children and adolescents. But now this kind of books with the nature of tools and guidelines can not meet the needs of readers in the context of interdisciplinary teaching, either in terms of content or form, children's popular science books need innovative representation and STEAM interdisciplinary knowledge to arouse children's curiosity. "STEAM science is great", "STEAM science moves", "STEAM into the Wonderful World of science" etc just hearing the name, and encyclopaedia completely different. These books present a new interpretation of scientific knowledge in the form of everyday, casual, inquisitive, experimental representations. It is the use of this kind of content to represent the advantages generated by the potential, so that on the one hand, the producers can gradually expand and occupy the popular science books market, on the other hand, it can combine the book resources and the industry resources to maximize the knowledge storage.

2.2 efficient integration and coordination of external and internal resources of publishing institutions based on knowledge sharing

Including but not limited to the internal knowledge sharing

exchange meeting, the master apprentice system, the project system, the study exchange forum and so on tacit knowledge transmission, carries on the topic selection development in the internal unified arrangement. Steam Educational Book Development Project is an interdisciplinary, multifunctional behavior process, people continuously acquire and create knowledge, and use it, thus realizing the continuous cycle of knowledge. [] therefore, the implementation process of a STEAM educational publishing project is also the operation process of knowledge management, from time to time, each stage of the project will form stage knowledge, there is knowledge sharing between stages; At the organizational level, each organization involves individual and team knowledge, internal and external knowledge and their interaction and influence with each other From the constitution, it usually involves the knowledge barriers of the project itself, the knowledge of publishing industry and the knowledge of project management. Therefore, only through the method of knowledge sharing, can improve the development of such books to master the degree of decision making.

2.3 Optimizing the content itself through knowledge internalization and assimilation

The application of knowledge management in the development of STEAM books will greatly improve the execution and replicability of book projects. For example, in the process of developing a library of resources for innovative thinking and thinking, an instruction book for the interpretation of interdisciplinary concepts, a case study of a book analysis of relevant classroom practices, an instruction manual for inquiry learning topics, exercises for innovative thinking and thinking, and a resource for groundbreaking learning content, these related knowledge management will continue throughout the entire production and implementation process of STEAM educational publications. In the process of knowledge internalization and absorption, it is necessary to form clear knowledge classification and knowledge point extraction. The first step is to classify the content of STEAM education publications provided by the author into categories of knowledge according to the clarity of the content and the extraction of points of knowledge, or to classify the elements of knowledge by means of a visual knowledge atlas. For example, we can classify and absorb explicit knowledge from four aspects: political ideology, science, systematicness and readability. In the second step, the optimized knowledge is translated into the online knowledge management information system and the off-line text manual through the personal knowledge system, in order to achieve the goal and effect of the knowledge level internalization absorption.

3. Conclusion

This study analyzes the ways of knowledge acquisition, storage, representation, sharing, innovation and integration of knowledge management and knowledge management in the development of popular science books for STEAM education, on the one hand, it is proposed to set up knowledge management organizations that are conducive to knowledge exchange, knowledge sharing and knowledge innovation by setting up four dimensions from the systematic, scientific, inter-disciplinary integration and situational issues, to build the culture atmosphere of knowledge management and core business process integration, and to construct the strategy of knowledge management environment and project promotion mechanism. On the other hand, through the method of knowledge management, aiming at knowledge innovation and high knowledge sharing, we constantly strengthen the ability of tacit knowledge representation and improve the inherent ability of explicit knowledge to enhance the mastery degree of knowledge of book development, solving the problem of topic selection and development of popular science books with the characteristics of interdisciplinary education.

References

[1] Yakman G. STEAM Education: An Overview of Creating a Model of Integrative Education. The Pupils Attitudes Toward Technology（Patt-19）Conference [C]. Salt Lake City: Patt, 2008.
[2] Liu Xiaoye, Yu Ting, Cheng Lixin. Topic Selection and Content Planning of Popular Science Books for Children Under The Concept of Stem Education [J]. Technology and Publishing, 2020 (11): 71-76.
[3] Peng Min, Guo Mengjiao. Research On The Basic Connotation and Development Path of Steam Education. Educational Theory and Practice, 2018, 38 (25): 14-18.
[4] Wei Xiaodong, Yu Bing, Yu Haibo. The Framework, Features and Implications of American Steam Education. Journal of East China Normal University, 2017, 35 (04): 40-46 + 134-135.
[5] Hiroko Takeuchi, Jiro Noaka. Spiral of Knowledge Creation [M]. Beijing: Intellectual Property Publishing House, 2006.
[6] Cho Jin-Bo. Do a Good Job of Knowledge Management to Make Teachers Work More Efficiently. Modern Educational Technology, 2003 (05): 68-[Japan] Hiroko Takeuchi, Yujiro Noaka. Spiral of Knowledge Creation [M]. Beijing: Intellectual Property Publishing House, 2006.71.
[7] Xu Ke, Wang Rui, Zhang Huiying. A Study on The Impact of Book Publishing Process, Knowledge Spiral and Employee Innovation Behavior —— Based on The Empirical Investigation of The Restructuring of Chinese Children Publishing Houses [J]. Forum on Statistics and Information, 2014, 29 (12): 91-98.
[8] Cheung Chi-Man. A Study on The Application of The Theory and Method of Knowledge Management in The Construction of Basic Education. Jilin University, 2005.