

MEANINGFUL EXPERIENCE IN SERVICE DESIGN FOR THE ELDERLY: SAPAD FRAMEWORK AND ITS CASE STUDY

Hu, Fei (1); Li, Jun (1); Wang, Wei (1); Sato, Keiichi (2)

1: School of Art & Design, Guangdong University of Technology; 2: Institute of Design, Illinois Institute of Technology

ABSTRACT

A growing trend of aging population of China has brought tremendous pressure on the domestic care system, and community education is one of the important content for elderly services. Based on the framework of SAPAD, the community English class in Guangzhou City is taken for case study. Depth research on three stakeholders—the elderly, social workers and volunteers are carried out by interview, user observation and field research. 6 levels (physical level, syntactic level, empirical level, semantic level, pragmatic level and social level) are extracted based on SAPAD framework, and the behavior-object-significance mapping is completed. Significant clusters of multiple users at different levels are analyzed, and 16 core significant clusters are jointly built. By linking with clustering results of the syntactic level, 6 new function modules are obtained. Finally, the community elderly education service system is built through personas, service blueprint, touch points and storyboard. The new service system will improve learning efficiency, satisfactions and emotional appeals for the elderly, and work efficiency of social workers and volunteers.

Keywords: SAPAD, Service design, Product architecture, Case study, Community education for the elderly

Contact:

Hu, Fei
Guangdong University of Technology
School of Art and Design
China, People's Republic of
philhu2002@hotmail.com

Cite this article: Hu, F., Li, J., Wang, W., Sato, K. (2019) 'Meaningful Experience in Service Design for the Elderly: SAPAD Framework and its Case Study', in *Proceedings of the 22nd International Conference on Engineering Design (ICED19)*, Delft, The Netherlands, 5-8 August 2019. DOI:10.1017/dsi.2019.315

1 INTRODUCTION

The Vienna International Plan of Action in Report of the World Assembly on Aging (1982), United Nations Principles for Older Persons (1991), And Guide to The National Implementation of The Madrid International Plan of Action on Ageing (2002, 2008) pointed out that appropriate education services shall be provided for the elderly so as to improve their development capacity and health & welfare, and the importance of lifetime education plan and community elderly education shall be emphasized so that the elderly can further contribute to the development of the society and country. Once retired after years of struggles, their roles in family and society will change correspondingly. Although basic material life of most elderly people has been guaranteed with the current development of society and economy, quick changes in living environment and role often produce negative emotions such as confusion, anxiety, aloneness and feeling of unreality. Hence, in order to guarantee the psychological and spiritual balance of the elderly and live an active and healthy old age, elderly education will play an irreplaceable important role in improving the life quality of the elderly (Findsen, 2007; Moon, 2011). For this purpose, this paper will explore and improve the community service for home care of elderly based on existing community elderly education experience.

Semiotic Approach to Product Architecture Design (SAPAD) (Hu *et al.*, 2013) was developed to incorporate meaning generation and usage in human-system interaction into conceptual system design process. SAPAD framework facilitates to understand user's meaning generation or signification patterns and to use them to compose system concepts and architecture. In this research a case study of SAPAD application to service system design of the elderly education in the community was conducted in order to further improve and extend the methodology regarding the interpretive mechanisms between user research data, user signification and service system that enables meaningful experience generation.

2 DEVELOPMENT STATUS OF COMMUNITY EDUCATION FOR THE ELDERLY

By literate search by TS=(elderly and community And education) in Web of Knowledge, there are ten key topics in 2,677 papers: geriatrics gerontology, gerontology, psychiatry, public environment occupational health, clinical neurology, medicine general internal, psychology, neurosciences, psychology clinical and health care sciences services. These researches will support the community education service design for the elderly on the technology and the content. For example, by examining the process of change and the retirement experiences of retirees using a longitudinal qualitative approach, Tam (2017) illustrates that learning is an integral part to experience and adapt to retirement. Tseng and Wu (2018) point that continuous elderly learning activities not only empower elderly populations' knowledge about health but also enhance these populations' social connections and social abilities, which can enhance their overall quality of life. Robinson-Dooley *et al.* (2018) discuss how university-community partnerships can be utilized to provide affordable and accessible health care for the elderly at community health clinics.

In China, the related researches (Li L., 2005; Duan, 2013; Li X., 2014; Yuan, 2018) pointed out main advantages of community education generally include the following: (1) predominant geological location. For the elderly with poorer physical function or stiff legs, their houses are close to the community, so they only take less energy and costs to go to school. (2) strong interaction. Relative to the colleges for the elderly, relatively few elderly people attend community elderly education courses, and exchange interactions between the elderly and teachers and among the elderly are more frequent. However, obvious problems also exist: (1) lack of special teaching places. Due to limited community resources, no special fixed teaching place is provided for elderly education in most communities, not to mention special learning places designed according to physical functions of the elderly. (2) Lack of system mechanism and professional team. Nowadays, community elderly education is still at the starting stage, and an authoritative standard has not been set up for the mode of attendance and mode of execution, etc. in different regions and blocks, etc. The learning demand of the elderly learning demand is greater than community supply, and teaching resources are unequally distributed. (3) An authoritative standard has not been set up for development of curriculum plans for community elderly education and selection of teaching materials. Its teaching content and learning rhythm are not necessarily applicable for the elderly, which

leads to that the teaching content and form are simple and the courses are less attractive. Besides, shortage of funds, lack of legislative protection and other problems exist.

3 SEMIOTIC APPROACH TO PRODUCT ARCHITECTURE DESIGN

The framework of Semiotic Approach to Product Architecture Design (SAPAD) attempts to explain the relationships between the object, behavior and signification dimensions. For a relatively simple activity such as tea-making and cooking, the dimension of “object” can be structured with four levels: assembly, object, unit and component ([Ulrich, 1995](#)). “behavior” dimension can be also structured with a hierarchical structure for example, with four levels, activity, process, action and operation ([Leont'ev, 1978, in Stanton, 2000](#)). However different disciplines have different definitions of terms representing levels of objects and behavior. Therefore SAPAD chose the term “activity” and ith-level action for multiple levels of “behavior” dimension, and the term “system” and ith-level object or ith-level subsystem for “object” dimension.

In the “signification” dimension, SAPAD uses the Semiotic Ladder framework introduced by [Stamper \(1996\)](#) and [Liu \(2000\)](#) with six levels of signification: (1) physical level, is about objects’ physical attributes which are related to enabling elements of functions such as material, signals, traces and physical distinctions. (2) Syntactic level, is about “how” to connect with each other between objects or the function modules. (3) Empiric level, is about “how” to connect the subject with object. It is related to the construction of logic, which focus on the operation, control and use of object, and the users’ experience such as mode, way, noise, redundancy and efficiency. (4) Semantic level, is about “why” to interact between individual and object, which relates to emotional experience and focus on emotion, character and persuasiveness of object, such as theme, expression and intention. (5) Pragmatic level, is about “how” to communicate and spread between one and another in interactions, which focuses on sub-culture and group identity. (6) Social level, is about social attributes in the activity, which focuses on value and ideology and relates to beliefs, expectation, commitment, contract, law and cultural convention.

The process of SAPAD framework application consists of three phases with eight steps. In order to effectively follow through this process, templates and tools for information acquisition and analysis have been developed.

3.1 Phase 1: Behavior observation and analysis

- Object Analysis produces an architectural description of a product or a service that represents its topological configuration of subsystems and components of the current system or practice.
- User Observation intends to capture the actual situation of product or service system usage. It attempts to capture the usage process, users’ states, various environments such as physical, social and cultural by videos, photos, notes and other means. Questionnaire survey and interviews before and/or after the observation can be also used in order to construct thorough information for a deeper understanding of the user behavior.
- Behavior analysis is to identify a structure of user’s behavior (activities, processes, action and operation).

3.2 Phase 2: Signification analysis and construction

- Excavating the under meaning of the user’s behavior by analyzing physical level, syntactic level, empiric level, semantic level, pragmatic level and social level, especially the latter three levels.
- Signification construction. Making sure of the accuracy and availability of signification through interviewing user again, at the same time, reconstructing signification cluster, insight into the crucial meaning of behavior and core values of the user and possible design directions by hierarchical clustering on the Design Structure Matrix (DSM, [Eppinger & Browning, 2012](#)).

3.3 Phase 3: Service/Product construction and design

- Signification-Objects Mapping. Combining with 3.1 and 3.2 to determine the mapping among signification cluster (semantic level, pragmatic level and social level) and things, defining the key objects of signification.

- Service/Product architecture DSM based on signification clusters. Evaluating the strength of the relationship between object-signification with integer value {0, 1, 2, 3} and identifying object clusters and developing a new system architecture.
- Design opportunities. Introducing new function and new architecture of the system, compelling design opportunities and concrete paths for innovation based on the new configuration of components, units, objects and assemblies.

4 CASE STUDY: SERVICE EXPERIENCE DESIGN OF COMMUNITY ELDERLY EDUCATION IN GUANGZHOU

4.1 Background research

This topic takes a Huanghuagang district in Guangzhou as a research object. This community is situated in the old city center of Guangzhou, and features convenient transport and complete living facilities. More elderly persons from Guangzhou can enjoy home-based care services in community, and neighborhood committees and family integrated service centers have been established, etc.

The family integrated service center provides perfect community services for the entire community, including families, teenagers, the elderly, corridor culture and volunteers. However, the family integrated service center can only provide small venues, so it often needs other organizations of the community to provide venues or cooperates with a social organization to hold an event. Community elderly education services provided by the family integrated service center are divided into 4 categories (22 theme classes in total): (1) Self-improvement: including Cantonese class, English class, mobile learning class, computer learning class, photography class, calligraphy class, bakery class and handcraft class; (2) health management: including health exercises, health knowledge, medical knowledge lecture, brain exercise and Tai Chi class; (3) recreation: including Cantonese opera class, dancing class, singing class, chorus class and films & television appreciation class; (4) safety teaching: including home safety knowledge education, anti-fraud knowledge publicity, legal knowledge lecture and financial management lecture.

After pre-investigating, observing and participating in elderly education activities and comparing the development status of different classes and differences of the elderly, the English classes are selected as the research object. The English classes for the elderly are generally attended by 6-8 persons, and are regularly opened every week. The class members generally are in good physical conditions, better grasp how to use mobile phones, is generally capable of skillfully communicate with others via WeChat and Moments, and frequently use Meitu software for photographing. Frequent network communication is established among the elderly, between the elderly and volunteers, between the elderly and social workers and between the volunteers and social workers. Besides, the volunteers and social workers of the English classes will constantly change and adjust the course plans according to actual demands of the elderly attending the interest classes, presenting certain advantages of community education.

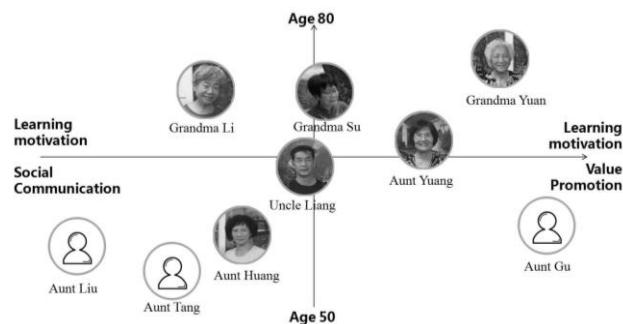


Figure 1. Elderly people participate in community english class

4.2 Stakeholder research

The elderly are recipients of community education; the volunteers are the implementers of community elderly education; and social workers are the organizers of community education; all of them are stakeholders of community education. The research group knows the elderly's daily life style and concept by the user observation method and interview method, learns the behaviors and attitudes as

the volunteers in the English classes by the participant observation method, collects the work behaviors and objectives, etc. by the interview method, obtains original data of three stakeholders, and understands different characters through analysis.

General processes of community elderly education are as follows: (1) planning phase. Know the residents' demands and hobbies & interests, confirm the theme, write a plan and submit it to the supervisor for approval. (2) recruitment phase. Recruit volunteers directly in the community, or find suitable volunteers by the volunteer department via QQ, WeChat groups and volunteer platform, etc. Recruit the elderly, post leaflets on the bulletin boards of the neighborhood committee and at the entrances of residential buildings, make publicity during the activities, and announce message in the WeChat groups and on the WeChat official accounts. (3) Implementation phase. Record the attendance conditions and emotion of the elderly during learning, and observe the existence of small groups and disputes in the classes, etc.

4.3 Behavior observation and analysis

The research groups analyzed respective typical behaviors starting from community education processes, with community elderly education experience as the service receiver and social workers and volunteers as the service providers.

From the perspective of the elderly, typical one-day community education activities include 6 scenarios: A1) learning demands; B1) preparation before class; C1) participation in a course; D1) self-reviewing after the class; E1) life application; F1) feedback. According to the behavior dimension of SAPAD framework, these activities are broken into tasks and sub-tasks. Taking scenario C as an example, T1) go to class; T2) attend lectures; T2 is further decomposed into the following: T2-1) chat with your class partners; T2-2) complete the group sign-up form; T2-3) attend the lectures of the volunteer teachers; T2-4) refer to and record the words you have not seen or cannot pronounce; T2-5) listen and repeat the words, sentences and texts; T2-6) raise own questions to the teachers; T2-7) carefully take notes, and write down the content and notes; T2-8) listen to the partners with a higher level of English language skills to explain grammar.

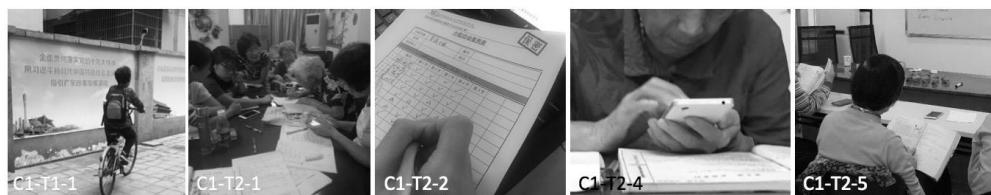


Figure 2. The elderly people attend english class

From the perspective of social workers, relevant behaviors are divided into the following: A2) preparation; B2) early implementation; C2) course (taking English courses as an example); D2) follow-up and feedback. C2) phase tasks T1) course preparation: T1-1) inform the volunteers to record each course and sign up; T1-2) introduce the courses and volunteers to the elderly.

From the perspective of the volunteers, relevant behaviors are divided into the following: A3) active recruitment; B3) early-stage preparation; C3) teaching English; D3) after-class work. C3) Teaching English may be broke in to the following: T1) mutual understanding: T1-1) walk to the activity center; T1-2) fill in the registration forms for volunteer service activities, and urge the elderly to complete the sign-up forms; T1-3) introduce the elderly each other, and have a chat; T2) give lessons: T2-1) impart knowledge; T2-2) write down notes; T2-3) answer questions of the elderly; T2-4) lead text reading; T2-5) arrange a short amount of practice.

4.4 Signification analysis and construction

According to SAPAD framework, mapping relationship includes physical level, syntactic level, empiric level, semantic level, pragmatic level and social level. Taking the semantic level as an example, which relates to human's emotion experience, and human's emotion and personality are emphasized. Through semantic level clustering, personal emotional appeals of three stakeholders are known, and core significances of personal emotion to community experience are determined.

Figure 3 shows significant clustering results of the semantic level of the elderly. The following 9 significant groups are divided: sense of safety, diligence & thrift, convenience & efficiency, enhanced

learning, expectation, frustration & sadness, pleasure & happiness, desire for communication and identification, sense of accomplishment and sense of satisfaction. Similarly, based on significant clustering results of the semantic level, 4 significant groups are divided: patience, anxiety, trust and tediousness; based on significant clustering results of the semantic level of the volunteers, 4 significant groups are divided: expectation, sense of responsibility, trouble and earnestness and patience.

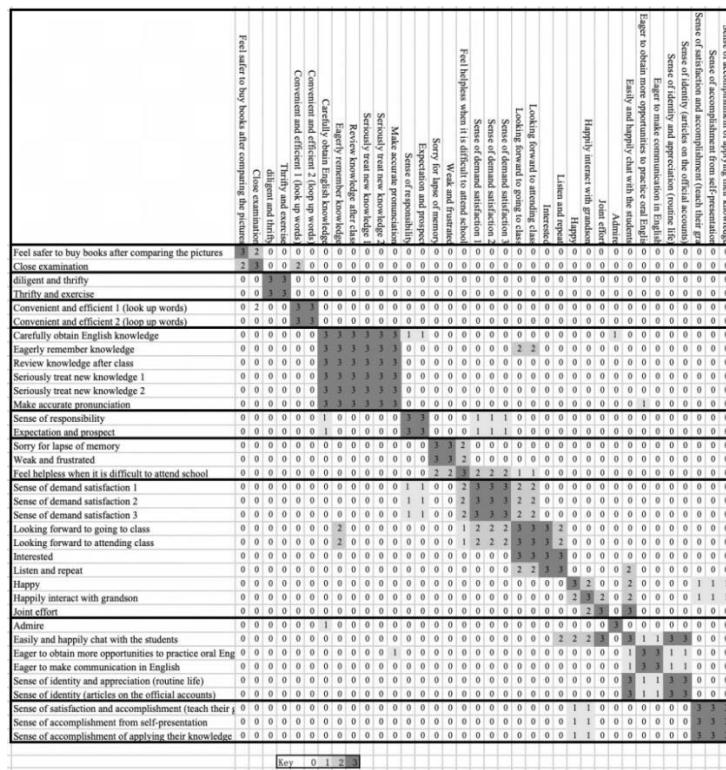


Figure 3. Significant cluster in semantic level of the elderly

Similarly, significant mapping analysis and significant clustering of three stakeholders are carried out from different levels. In terms of the elderly, 9 significant groups of the semantic level reflect the emotional appeals and experience of the elderly for community education experience; 5 significant groups of the pragmatic level include information communication, teaching interaction, emotional interaction with grandchildren, interaction with friends and self-value presentation, and the propagation property of the elderly in community education experience related behaviors is explained; 2 significant groups of the social level includes sense of social participation and cultural communication, and the value tendency and ideology of the elderly towards community education experience are explained. The following core significant clusters which support system construction are obtained by linking the correlation of three levels and summarizing core demands of the elderly.

In terms of social workers, significance of the social level is reflected by sense of social responsibility, while the significant cluster of the pragmatic level is reflected by course information communication, cooperative office and presentation of social workers' values; the significant clusters of the semantic level include patience, anxiety, trust and tediousness. Three core significant clusters are obtained through correlation analysis.

In terms of the volunteers, the significant clusters of the social level include realization of self-value and sense of social participation; the significant clusters of the pragmatic level include knowledge communication, exchange of ideas, course information communication feedback; those of the semantic level include expectation, sense of responsibility, trouble and earnestness & patience.

Through correlation analysis of significant clusters, the correlation among significant clusters are determined, but different tasks have different significant clusters and different correlations, hence different core significant clusters and design opportunities exist. In addition to significant clusters based on the correlation among the significant clusters of single user, we also need to pay attention to the relationship among the significant clusters of the stakeholders in the system – significant cluster related problems, contradictory relationship among significant clusters and lack of actual connectivity

among relevant significant clusters. Among the significant clusters for the elderly, social workers and volunteers, the following to-be-modified core significant clusters are shown in Figure 4.

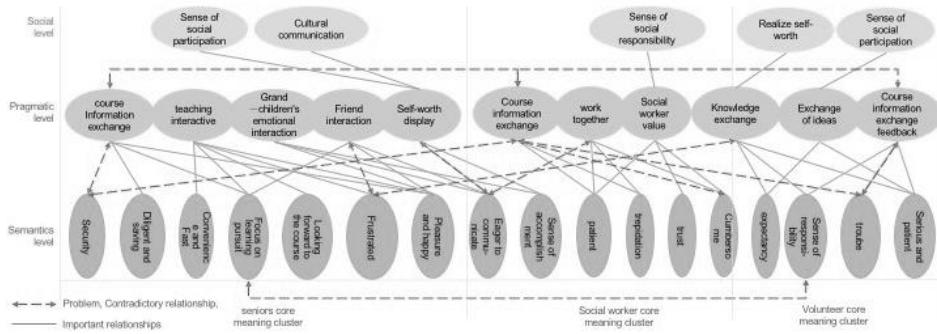


Figure 4. Core significant clusters of the stakeholders

For example, for cluster 13, course information is not communicated in time, and is not synchronized at any time, which leads to that detailed information is missing, so we need to consider the timeliness of information communication during construction of the community education experience system. For cluster 14, there are some contradictions between volunteer time distribution and the elderly's pursuit of learning, namely the volunteers do not necessarily have too much time to prepare lessons and adjust the courses, so we need to consider how to alleviate the volunteers' pressure of working by constructing the community experience system. In addition that the elderly participating in community education form fixed circles of friends to main their friendship, they can promote and support learning each other in such a way that the community education can achieve sustainable development. Besides, we pay attention to building a scenario for repeated learning and review for the elderly in the process of volunteer teaching, and lay emphasis on practical teaching. For cluster 16, the elderly can present their values only through few channels. In the process of constructing the community education experience system, the social workers can cooperate with other organizations so as to create more opportunities for the elderly to show themselves and contribute their remaining energy.

4.5 Mapping between core significant clusters and objects

According to SAPAD framework, it is necessary to map its relative behaviors and significant correlates after excavation of significance. In the service system, the significant correlates and environment correspond to the system contacts accessible by the users. The core significance centered object relationship is established based on mapping relationship, and new function modules are reorganized or generated. Thus, a new service system is established.

Through above analysis, the contacts for the elderly include social worker, volunteer, audience, hotel staff, travelling companion, mobile phone (telephone), WeChat, photo album, WeChat official account, electronic photo album, dictionary app, feedback questionnaire, notebook, pen, teaching material, backpack, class partners, music score and Tai Chi book, while environment contacts include house, community center/ neighborhood committee, bookstore, family integrated service center, foreign hotel, community activity center stage and Huanghuagang Commemoration Park. The contacts for social workers include resident, elderly, volunteer, administrative staff, staff of the neighborhood committee/cultural activity station, plan, venue booking application form, questionnaire, notebook, pen, registration form for volunteer service activity, sign-up form for the elderly, computer, mobile phone, while the environment contacts include community center, school and family integrated service center; the contacts for the volunteers include elderly, social worker, registration form for volunteer service activity, sign-up form for the elderly, mobile phone, blackboard, computer and teaching material, while the environment contacts include community center, school and family integrated service center.

The syntactic level clusters are analyzed for reorganization from the perspective of core significant clusters, and are divided into new different modules. The new syntactic level meets the demands for core significant clusters and also meets expectations and emotional demands of three stakeholders for community education experience. The communication elderly education experience system is constructed based on functional modules of the new service system.

Through above analysis, 6 modules are obtained after the syntactic level is reorganized: A. information storage and communication module; B. multi-dimensional teaching module; C. social

learning circle; D. self-presentation module; E. incentive mechanism module; F. skipped-generation interaction module, as the basis for designing and constructing the community elderly education experience system in future.

Fig. 5 shows the relationship between functional service modules and stakeholders, as well as contacts. Community elderly education services cannot be provided by single institution such as family integrated service center. The community center and neighborhood committee in the community and social organizations outside the community shall cooperate with each other to jointly provide services. Besides, the environment contacts are not limited to those in the community, and bring benign effects within the entire service scope.

Service function of syntactic level	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16
Elderly	A												A			
	A												A			
													A			
													A			
		B														
			C/E													
				B												
Social workers								D							D	
								A					A			
									A				A		D	
									D				A			
										A			A			
										A			A			
										A			A			
Volunteers									A				A		A	
										A			A		A	
											B		B			

Figure 5. Relations between service function to core significant cluster

4.6 Construction of community elderly education service system

The new community elderly education service system covers information storage and communication module, multi-dimensional teaching module, social learning circle, self-presentation module, incentive mechanism module and skipped-generation interaction module. These 6 different modules are inlaid with each other, and are linked together in the system. Seen from the figure 6, a community education information platform is added to link services in the entire service system so as to balance the demands and expectations of three stakeholders. The community education information platform is built based on WeChat applet technology, without heavier program load on the elderly's mobile phones so that the platform can provide system services for the elderly through existing WeChat programs and bring functional effects of the applets; a computer terminal for management is designed for social workers so that the social workers can effectively manage community activities at normal working hours.

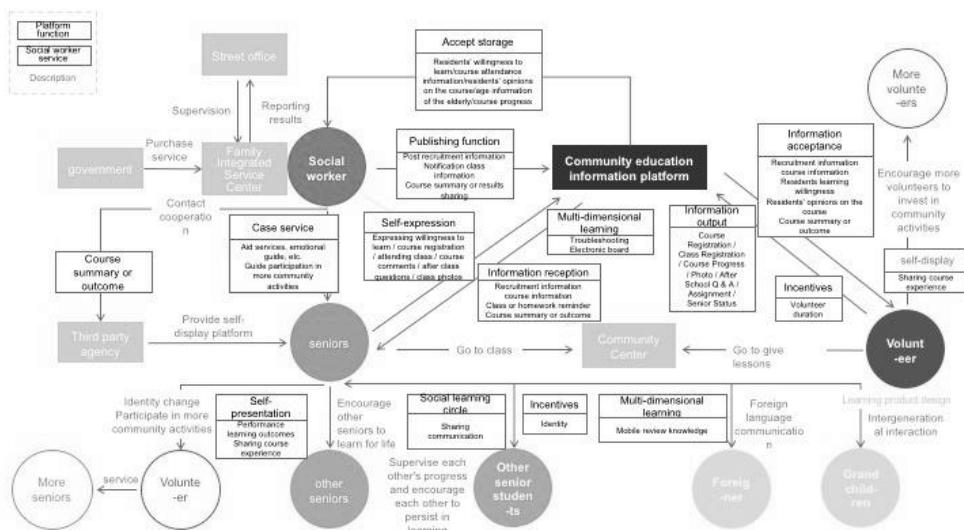


Figure 6. Community elderly education service system

In terms of the contacts, the diversity of service contacts is maintained in the new system whenever possible. In the system, some paper form contacts are substituted by the platform, thus improving communication efficiency among the elderly, social workers and volunteers and providing faster and more convenient work methods for the social workers; case service and other interpersonal contacts between social workers are retained; product contacts between the elderly and grandchildren are retained, and more opportunities for contract between the elderly and other link-minded elderly people are brought, namely the elderly have more fun from community elderly education. Contact and feedback between the elderly and community are maintained, so that the elderly can be deeply involved in community education activities and other activities. From the perspective of social workers, information collection and feedback efficiency is improved, and the social workers' workload for transmitting record information between different media is alleviated depending on information storage function of the platform. From the perspective of the volunteers, their workload is alleviated through the platform, and they can keep timely records and provide information feedback to the social workers.

The core objectives for design of the service system are to improve the efficiency of communication among stakeholders, improve the users' contact experience and provide a benign cycle for the community elderly education service system. According to above system design and behavior processes of three main users, operation of the service system can be expressed in the form of service blueprint, as shown in Figure 7.

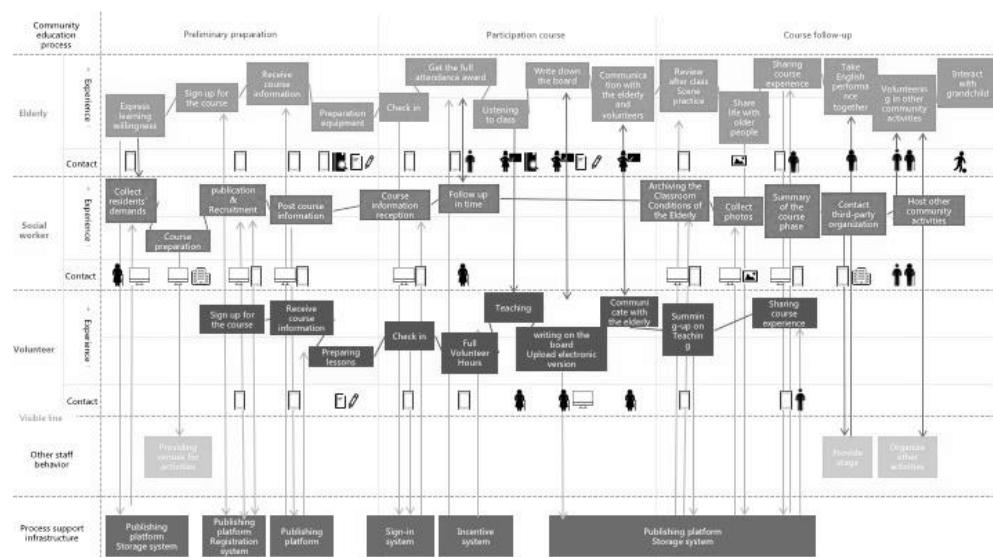


Figure 7. Service blueprint of community education for elderly

5 CONCLUSION

In this paper, the community English class in Guangzhou City is taken for case study, and daily follow-up of three main stakeholders – the elderly, social workers and volunteers for community elderly education experience and related depth research are carried out by the interview and user observation. The related important behaviors are found out according to the users' daily life pattern, for example, the objectives and expectations of the elderly, social workers and volunteers for community education experience are observed by reading English articles on the official accounts, interacting and communicating with grandchildren in English, watching English programs and communicating with local people in English during tourism. 6 levels are extracted based on SAPAD framework, and the behavior-object-significance mapping is completed. Significant clusters of multiple users at different levels are analyzed, and 16 core significant clusters are jointly built. By linking with clustering results of the syntactic level, 6 new function modules are obtained - information storage and communication module, multi-dimensional teaching module, social learning circle, self-presentation module, incentive mechanism and skipped-generation interaction module. System objectives are determined and the demands of three stakeholders are balanced by analyzing the semantic level, pragmatic level and social level. Finally, the community elderly education service system is built through personas, service blueprint, touch points and storyboard. The above service blueprint includes main behavior processes, experiential emotions and contacts of three stakeholders, as well as other staff's behaviors,

infrastructure supports and information flow of the entire community education process. Compared with the existing service system, experience of three stakeholders and user's emotion are improved in the newly designed community elderly education service system.

To the research methodology, the semiotic ladder model used in SAPAD provides a guiding structure for sorting complex patterns of user's behavior with its six-layer categorization scheme. This structure facilitated identification of different types of significations or meaning generation by stakeholders. For service system design, understanding deeper meanings that users generate on the elements of their experience including their actions, relevant objects and events and states of environments is critical for specifying service functions, their structure and the way delivered to users. SAPAD framework has upgraded from product architecture that involves complex interactions to the service system that involves complex activities, to seek for meaningful experience.

REFERENCES

- Yinxue, D. (2013), *The study on building the pattern of urban community geriatric education in our country*, Master Thesis, Jiangxi Normal University. In Chinese.
- Eppinger, S.D. and Browning, T.R.(2012), *Design Structure Matrix Methods and Applications*, MIT Press, Cambridge.
- Findsen, (2007), "B-Preirean Philosophy and Pedagogy in the adult education context: The case of older adults learning", *Studies in philosophy and education*, Vol. 26, pp. 545–559.
- Hu, F. Sato., K. et al. (2013), "Semiotic basis for designing product architecture", *The 19th international conference on engineering design*, Seoul, 2013, pp. 19–22.
- Hu F, Zhang X. et al. (2015), "Semiotics Approach to Product Architecture Design: a Case Study of Cooking Activity", *Advances in engineering research*, Vol. 38, pp. 654–664.
- Hu F, Sato K. et al. (2018), "Meaningful Experience in Service Design: Case Study of SAPAD Framework Application", *The 25th international conference on transdisciplinary engineering*, Modena (Italy).
- Lei, L. (2005), *The choice of community education model with the background of lifelong education*. Master Thesis, Jilin Agricultural University. In Chinese.
- Liu, K. (2000), *Semiotics in information systems engineering*, Cambridge University Press, United Kingdom.
- Xueshu, L. (2014), "Reflection on the Development and Research into Elderly Education Home and Abroad", *Comparative education review*, Vol. 11, pp. 54–59. In Chinese.
- Lloyd-Sherlock, P., McDonald, T., Mujahid, G. and Nusberg, C. (2008), *Guide to the national implementation of the Madrid international plan of action on aging*, Working Paper. United Nations Department of Economic and Social Affairs, New York.
- Tam, M. (2017), "Retirement and learning: A longitudinal qualitative approach", *Educational Gerontology*, Vol. 44 No. 1, 54–63.
- Moon, P.J. (2011), "Bereaved elders: Transformative Learning in later life", *Comparative education review Adult Education Quarterly*, Vol. 61 No. 1, pp. 22–39.
- Robinson-Dooley, V., Dumont, K., and Riapos, J.A. (2018), "Aging & community health: A university–Community partnership project". *Educational Gerontology*, Vol. 44 No. 4, pp. 220–225.
- Stamper R. (1996), "Signs, Norms, and Information Systems", *Signs of work*, Walter de Gruyter, Berlin, Germany, pp. 349–397.
- Stone, R.B., Wood K.L. and Crawford R.H. (2000), "Using Quantitative Functional Models to Develop Product Architectures", *Design studied*, Vol. 21 No. 3, pp. 239–260.
- Tseng M.-H., Wu H.-C. (2018), "The geographic accessibility and inequality of community-based elderly learning resources: A remodeling assessment 2009~2017", *Educational Gerontology*, Vol. 44, pp. 226–246.
- Ulrich K. T. and Steven D. E. (1995), *Product design and development*, MacGraw-Hill, New York.
- Ulrich K. T. (1995), "The role of product architecture in the manufacturing firm", *Research policy*, Vol. 24, pp. 419–440
- United Nations (1982), *Report of the world assembly on aging*.
<https://www.un.org/development/desa/ageing/resources/vienna-international-plan-of-action.html>
- United Nations (1991), *Principles for older persons adopted by general assembly resolution*.
<https://www.ohchr.org/en/professionalinterest/pages/olderpersons.aspx>
- Yan, Y. (2018), *Research on the pattern construction of elderly education in urban community*. Master Thesis, Fujian Agricultural and Forestry University. In Chinese.
- Zhang, X., Hu, F., Zhou, K. (2017), "Reflecting Meaning of User Experience: Semiotics Approach to Product Architecture Design", *Transdisciplinary engineering: a paradigm shift*, Vol. 5, pp. 329–337.

ACKNOWLEDGMENTS

This paper is funded by Humanities and Social Sciences Foundation of the Ministry of Education, China (19YJC760109), Guangdong social science research base project "The Design Science and Art Research Center of GDUT", and the Project of "Guangdong experience design integration innovation team"(2016WCXTD013).