Based on Usability Experience-Enhanced Potential Community Transportation Design Study in China: A Case of Kindergarten Bus Stop Design

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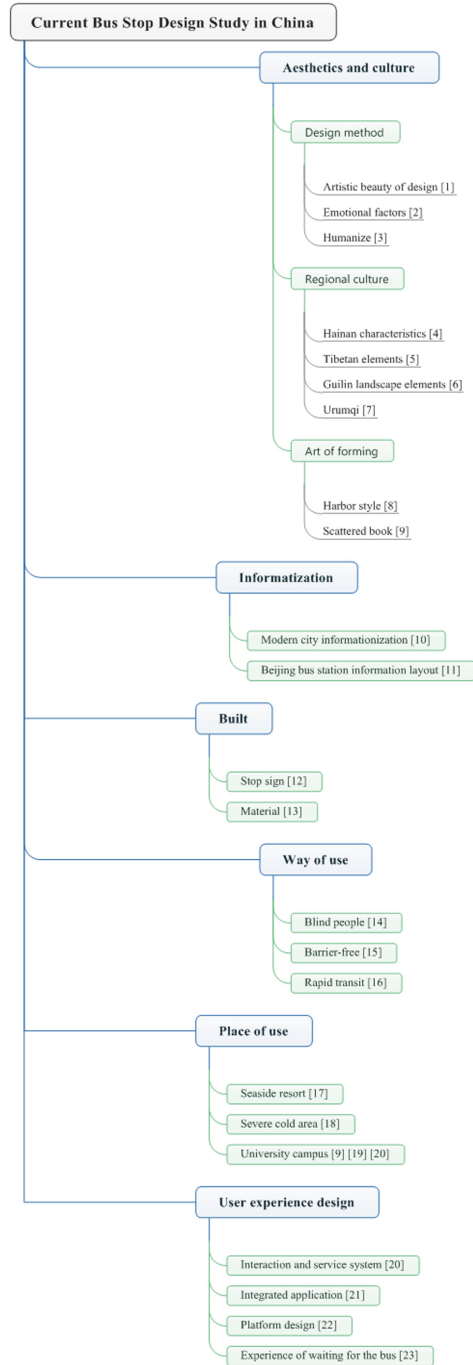People's Republic of China
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Abstract. With the development of China's economy and the improvement of urban living standards, the design and study of urban bus stations has become an emerging topic in recent years. The current study on the design of urban bus stops in China is distributed in the following six areas: aesthetics and culture, informatization, built, way of use, place of use, and user experience design. With the advent of the service design and experience economy era, study on bus stations with user experience design as the core has become a hot topic in recent years, which includes interaction and service system, integrated application, platform design, and experience of waiting for the bus. The design of community transportation bus stops based on university campuses, has gradually received attention. However, little attention has been paid to the experience and design of bus stop associated with school transfers close to kindergartens, which is the most important issue to the community transportation. Hence, this emphasizes the need for exploring potential user experience design factors for community transportation design in a case of bus stop design to kindergarten in China, which is this paper aimed at. Based on the result of the study, a bus stop design potential framework for children is proposed in terms of experience design, where the nine factors need to be considered when designing bus stop to help with safety and comfort for children in line with problems and factors: the four problems when waiting for the bus with children at the bus stop, the three inappropriate factors of the current bus stop, and the six inappropriate factors for protection of children safety in the current bus stop design.

Keywords: Community transportation · Kindergarten bus stop design ·
Usability · Transportation experience

1 Introduction

With the development of China's economy and the improvement of urban living standards, the design and study of urban bus stations has become an emerging topic in recent years. As shown in Fig. 1, the current study on the design of urban bus stops in

Fig. 1. The current bus stop design study in China (devised by the authors based on the literature).

China is distributed in the following six areas: aesthetics and culture [1–9], informatization [10, 11], built [12, 13], way of use [14–16], place of use [9, 17–20], and user experience design [20–23]. Among them, the study mainly focuses on the aesthetics and culture of the station, which involves: design method [1–3], regional culture [4–7], and art of forming [8, 9]. Moreover, with the advent of the service design and experience economy era, research on bus stations with user experience design as the core has become a hot topic in recent years. These studies include: interaction and service system [20], integrated application [21], platform design [22], and experience of waiting for the bus [23]. Furthermore, the design of community transportation bus stops based on university campuses [9, 19, 20], has gradually received attention. However, little attention has been paid to the experience and design of bus stop associated with school transfers close to kindergartens, which is the most important issue to the community transportation. Hence, this emphasizes the need for exploring potential user experience design factors for community transportation design in a case of bus stop design to kindergarten in China, which is this paper aimed at.

2   Research Methods

A semi-structure online questionnaire was adopted to explore the user (parents and children) experience to the current bus stop and design, based on parents' views. As shown in Fig. 2, the structure and questions are designed for the questionnaire that has been upload to asking.wenjoy.com. The semi-structure online questionnaire has been sent to parents' groups of a kindergarten in Guangzhou, China, via WeChat that is the most popular social media platform in China. 93 completed questionnaires have been received within a week. SPSS (Statistical Product and Service Solutions) software is used for the quantitative data analysis and content analysis is implemented for qualitative answer.

3   Results

3.1   The Most Frequently Used Means of Transportation for Kindergarten

The questionnaire respondents were asked to select the most frequently used means of transportation for taking their children to go to and back from kindergarten. The results in Fig. 3 show that more than half of (54.8%) responding parents most used their own cars for sending to and taking back their children from kindergarten than using public transportation bus (15.1%). Interestingly, there is no one selected the subway as the transportation for their kids. However, nearly one third of (30.1%) responding parents reported that their employed other methods, which were bicycle and electric bicycle.

Λ Asking
- Home

About Kindergarten Bus Stop Design

* Mandatory

* 1. The most frequently used means of transportation for your children to and back from kindergarten is:
○ Bus
○ Drive
○ The subway
○ Other

* 2. How long do you usually wait for a bus :
○ Less than 5 minutes
○ 5-10 minutes
○ More than 10 minutes

* 3. Do you often take your children on the bus?
○ Yes
○ No

* 4. What do you do when you wait for the bus?
○ Reacing/mobile phone
○ Chatting with children
○ Concentrate on waiting for the bus
○ Other

* 5. What does your child do while waiting for the bus?
○ Reacing/mobile phone
○ Play

○ Concentrate on waiting for the bus
○ Other

* 6. Do you think the current bus stop is appropriate?
○ Appropriate
○ Inappropriate

* 7. Why ?

* 8. Do you think the current bus stop design can protect your child's safety?
○ Yes
○ No

* 9. Why ?

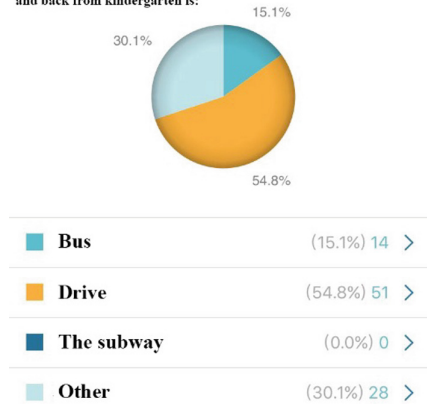* 10. Would you like to have a bus stop specially designed for children?
○ Yes
○ No

* 11. What problems do you have with your children waiting for the bus? Why is that?

* 12. What do you think needs to be added to children's bus stops to help with safety and comfort?

Submit

Fig. 2. The structure and questions of a semi-structure questionnaire for exploring the user experience to the current bus stop and design, based on parents' views (devised by the authors).

The most frequently used means of transportation for your children to
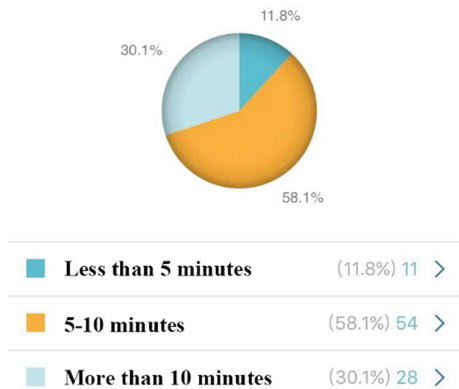and back from kindergarten is:

15.1%

30.1%

54.8%

	Bus	(15.1%) 14 >
	Drive	(54.8%) 51 >
	The subway	(0.0%) 0 >
	Other	(30.1%) 28 >

Fig. 3. The most frequently used means of transportation for children go to and back from kindergarten (responding parents' view).

3.2 Parents' Waiting Time for Their Buses

The questionnaire respondents were asked to select their waiting time for their buses at bus stops. The results are shown in Fig. 4, which suggests that overwhelming (88.2%) responding parents spent more than five minutes on waiting for their buses. It even cost more than 10 min of nearly one third of (30.1%) responding parents for it.

How long do you usually wait for a bus:

11.8%

30.1%

58.1%

	Less than 5 minutes	(11.8%) 11 >
	5-10 minutes	(58.1%) 54 >
	More than 10 minutes	(30.1%) 28 >

Fig. 4. Parents' waiting time for their buses at bus stops for taking their children to go to and back from kindergarten (responding parents' view).

3.3   Parents with Their Children for Their Buses

The questionnaire respondents were asked whether they usually take their children with them for their buses. As shown in Fig. 5, about one fourth of (28%) responding parents use to bring their children with them on the buses.

Do you often take your children on the bus?

28.0%

72.0%

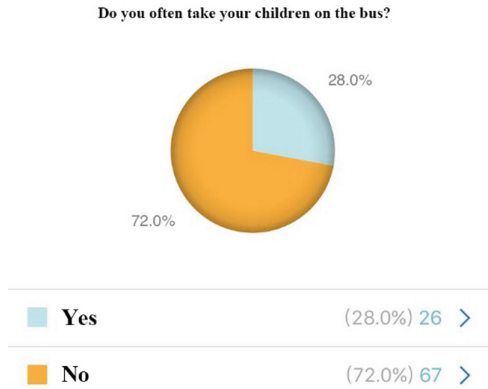|	Yes	(28.0%) 26 >
	No	(72.0%) 67 >

Fig. 5. Parents with their children for their buses (responding parents' view).

3.4   What Parents Do When They Wait for Their Buses

The questionnaire respondents were asked to select what they do when they wait for their buses. The results in Fig. 6 show that more than two fifth of (41.9%) responding parents chat with their children, nearly one third of (31.2%) them do nothing but waiting, about one fourth of (23.7%) them prefer reading/mobile phone, and few of (3.2%) them prefer other things without providing any further information.

What do you do when you wait for the bus?

3.2%
23.7%
31.2%
41.9%

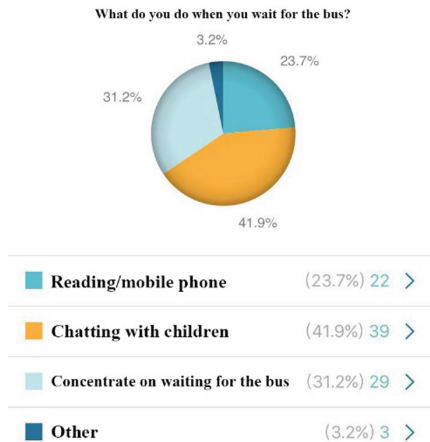|	Reading/mobile phone	(23.7%) 22 >
	Chatting with children	(41.9%) 39 >
	Concentrate on waiting for the bus	(31.2%) 29 >
	Other	(3.2%) 3 >

Fig. 6. What parents do when they wait for their buses (responding parents' view).

3.5   What Children Do When They Wait for Their Buses

The questionnaire respondents were asked to select what their children do when they wait for their buses. The results in Fig. 7 show that more than two fifth of (41.9%) responding parents reported that their children do nothing but waiting. More than one fourth of (26.9%) the parents saw their children playing. About one fifth of (22.6%) the parents stated that their children prefer reading or using mobile phone instead doing nothing. Nearly one tenth of (8.6%) them revealed that their children are doing other things without providing any further information.
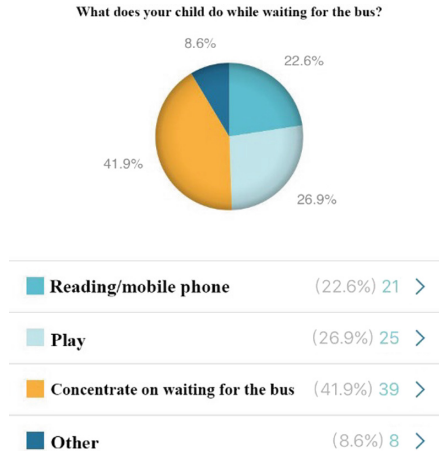

What does your child do while waiting for the bus?

■ Reading/mobile phone	(22.6%) 21	>
■ Play	(26.9%) 25	>
■ Concentrate on waiting for the bus	(41.9%) 39	>
■ Other	(8.6%) 8	>

Fig. 7. What children do when they wait for their buses (responding parents' view).

3.6   Appropriateness of Current Bus Stop

The questionnaire respondents were asked whether they think the current bus stop is appropriate. As shown in Fig. 8, nearly half of (45.2%) responding parents thought that the current bus stop is inappropriate.
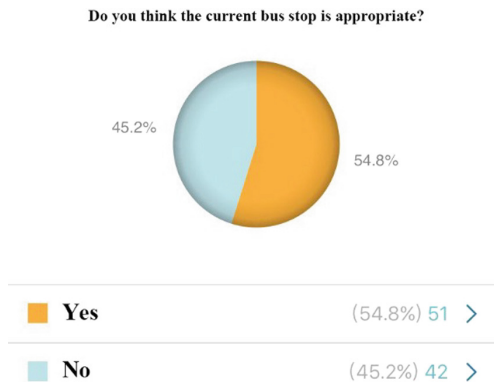

Do you think the current bus stop is appropriate?

■ Yes	(54.8%) 51	>
■ No	(45.2%) 42	>

Fig. 8. Appropriateness of current bus stop (responding parents' view).

The questionnaire respondents were further asked to provide their qualitative opinion to the reasons of their answers to the current bus stop appropriateness. Most of the responding parents believed that the current design of bus stop is appropriate, since the location of the stop, frequency of the bus, and the distance between bus stops are acceptable.

However, there are 36 of the responding parents provide their views on inappropriate issues of the current bus stop. As shown in Table 1, there are three main inappropriate issues of the current bus stop according to the responding parents' perspective, which are experience design issue, safety issue, and location issue. 19 of responding parents stated that the experience design causes inappropriateness of the current bus stop, where the lack of human experience centered design, easily getting crowded and confused when getting on the bus, and inadequate facilities for waiting the bus, are the most concerned three aspects. They also thought that the bus stop design did not consider the issue of children, and further suggested that there should be a dedicated bus stop for children. 12 of responding parents worried about the safety issues of current bus stop, which include lack of protection when children playing within the stop, lack of protection when getting on and off the bus, waiting on the road caused by inadequate space of the bus stop for waiting, and lack of caution lines to warm danger area of when waiting. Several responding parents indicate the lack of bus stop in their convenient distance range is the key location issue.
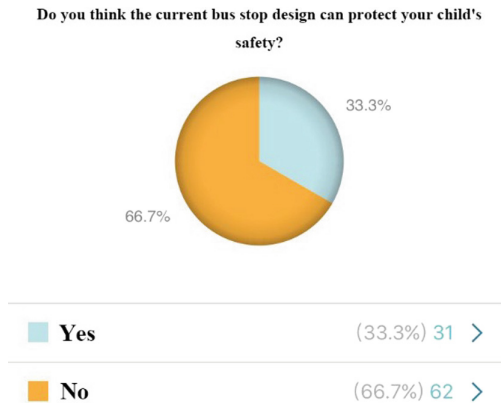
Table 1. The inappropriate issues of the current bus stop (responding parents' view).

Issues	Aspects of opinions	Number of mentions
Safety	Fear of danger while the child is playing	1
	There are always electric bikes and shuttles when getting on and off the bus	1
	Some places where the station is set up are unreasonable. The platform should be set up in a relatively empty place to avoid the danger of traffic accidents caused by people waiting for the car to stand on the road	1
	There is no yellow line or red line in the danger area for warning	1
	Other potential dangers for children (without any further information)	8
Location	There is no bus stop close to my home	4
	The distances between bus stops are not equal and lack of unified planning	1
Experience design	Lack of human experience centered design	7
	When the bus stops, passengers can easily get crowded and confused when they get on the bus	7
	Inadequate facilities for waiting	2
	Not clean and comfortable	1
	Too many ads are boring, which can be interesting content or bus messages	1
	Most of the city has station kiosks, and other areas have not been equipped	1

3.7   Current Bus Stop Design for Protection of Children Safety

The questionnaire respondents were asked whether they think the current bus stop can protect their children. As shown in Fig. 9, two third of (66.7%) responding parents thought that the current bus stop design can not protect their children when they waiting for the bus.

Do you think the current bus stop design can protect your child's safety?

33.3%

66.7%

	Yes	(33.3%) 31 >
	No	(66.7%) 62 >

Fig. 9. Current bus stop design for protection of children safety (responding parents' view).

The questionnaire respondents were further asked to provide their qualitative opinion to the reasons of their answers to the current bus stop design for protection of children safety. Most of the responding parents believed that the current design of bus stop works for their children protection, because the stop platform embankment is higher than the road; and every bus stop is carefully designed (without any further information). Interestingly, a responding parents stated that child safety awareness requires parental guidance and role models to the bus stop.

However, 47 of the responding parents provide their views on the inappropriate issues for protection of children safety in the current bus stop design. As shown in Table 2, there are six main inappropriate issues of the current bus stop design according to the responding parents' perspective, which are related to experience design, fence, departure area, a dedicated way, platform, and waiting area. 14 of the responding parents stated that inadequate facilities for safety of children, and lack of dedicated design for children to use are the most concerned experience design aspects. As one responding parent made it clear that the function of the current bus stop is small, but there is a place for people waiting for the bus to shelter from the rain. 15 of the responding parents concern fence issue, because, without a barrier, the child would run into the road easily, and could cause danger without guardrail for queuing since the queuing order is poor in China. There are two issues indicated by seven of the responding parents: people are crowded and children are not safe to get on and off; and there are always electric bikes and shuttles when getting on and off the bus. Five of the responding parents thought that a dedicated way for children should be considered as
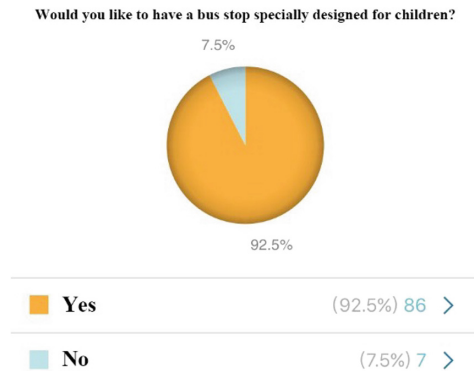
children fall down easily and more likely to walk on the bus path when they get on the bus. Some responding parents pointed out that the platform of the bus stop is too close and facing to the road and without dedicated waiting area for children.

Table 2. The inappropriate issues for protection of children safety in the current bus stop design (responding parents' view).

Issues	Aspects of opinions	Number of mentions
A dedicated way	Children fall down easily, and there is no passage designed for children	3
	Children are more likely to walk on the bus path when they get on	2
Fence	Without a barrier, the child would run into the road	14
	There is no guardrail for queuing, and the queuing order is poor in China, which causes danger	1
Platform	No dedicated platform for children	2
	Too close and facing to the road	2
Waiting area	There is no waiting area for children	2
Departure area	People are crowded and children are not safe to get on and off	5
	There are always electric bikes and shuttles when getting on and off the bus	2
Experience design	Inadequate facilities for safety of children	10
	Lack of dedicated design for children to use	4

3.8   A Bus Stop Specially Designed for Children

The questionnaire respondents were asked whether they would like to have a bus stop specially designed for children. As shown in Fig. 10, a vast majority of (92.5%) responding parents said YES to the question.

Fig. 10. A bus stop specially designed for children (responding parents' view).

3.9   Problems When Waiting for the Bus with Children at the Bus Stop

The questionnaire respondents were asked to provide qualitative views for what problems they had with your children when waiting for the bus at the bus stop. 66 of the responding parents provided their perspectives. As shown in Table 3, there are six key related issues elected by responding parents to the problems when waiting for the bus with children at the bus stop, which are parent, children, other passengers, bus stop, bus, and environment. There are 33 responding parents highlighted that passengers are crowded without lined up, resulting in getting on the bus disorderly, which could potentially hurt children. This could be blamed for inadequate guardrail in bust stop, as one responding parent emphasized that, because there is no order to get on the bus, if there is no guardrail, children will be squeezed and collision. The bus stop related problems are associated with waiting seat, guardrail, on-stop information board, platform space and roof, and form outlook design. Interestingly, one responding parent raised a issue of environment, which the bus exhaust emission could be harmful to children when waiting in a open space.

Table 3. The problems when waiting for the bus with children at the bus stop (responding parents' view).

Issues	Aspects of opinions	Number of mentions
Parent	Need to hold the child's hand tightly, fearing that the child will be unsafe for naughty, or child will rush out when the bus is approaching the station	3
	Keep an eye on the children for fear of danger	2
	Boring	1
Children	Children will run around, which will not be safe enough	4
	Easy to walk into the driveway	1
Other passengers	Crowded and not lined up	30
	Get on the bus disorderly	3
Bus stop	Inadequate waiting seat, such as special seat for child, comfortable seat, dirty seat, and without seat at all	5
	Inadequate guardrail	2
	Ineffective user friendly on-stop information board for children	2
	Insufficient platform space	1
	Insufficient platform roof in the case of rain	1
	Inadequate bus stop form outlook design	1
Bus	Long waiting time	4
	Irregular approach and departure, such as dangerous parking method, stopped before arriving at the station, and too short to stay	4
	Delay	1
Environment	Bus exhaust emission could be harmful to children	1

3.10   Things Need to Be Added into Bus Stop to Help with Safety and Comfort for Children

The questionnaire respondents were asked to provide qualitative views for what kind of things need to be added into bus stop to help with safety and comfort for children. 84 of the responding parents provided their suggestions. As shown in Table 4, there are night key related issues suggested by responding parents to the things need to be added into bus stop to help with safety and comfort for children, which include platform, roof, seat, guardrail, information board, waiting area, boarding area, experience, and dedicated bus station. Safety related issues, such as guardrail, and boarding area, are caught more attention of the responding parents. In addition, the responding parents more concerned seat number, safety and comfort, and even special seat for children. Further, the responding parents suggested following aspects to improve user experience of parents and children: to add devices that interest children so they don't get bored waiting for a bus, such as toy, and showing short animation film, to range a staff to maintain order at the stop and look after the children, to put a water machine at the stop, and to keep clean environment. They even went further for calling for design dedicated bus station for parents and children, which is close to kindergarten.

Table 4. The things need to be added into bus stop to help with safety and comfort for children (responding parents' view).

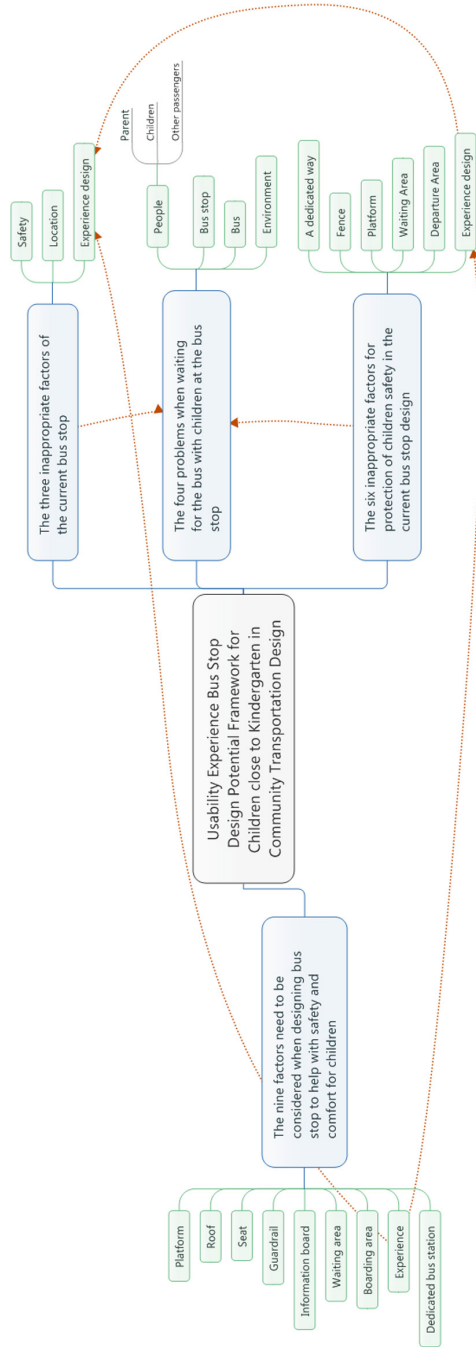| Issues	Aspects of opinions	Number of mentions
Platform	Spacious docking station	1
	Access to the sidewalk requires precautions	1
Roof	Children's taste can partly shelter from wind and rain	1
Seat	More seats	11
	Safe and comfortable seat	7
	Special seat for children	7
Guardrail	Add guardrails so passengers can get on the train in an orderly way	13
Information board	Add bus arrival information prompts	3
	User friendly for children	1
Waiting area	Set up a waiting area for children	5
	Reading area	4
Boarding area	Children express boarding path	6
	Add guardrail to set up safe boarding path	3
	Need staff to guide the safety of getting on and off the bus	3

Table 4. (*continued*)

Issues	Aspects of opinions	Number of mentions
Experience	Add devices that interest children so they don't get bored waiting for a bus, such as toy, and showing short animation film	7
	Need a staff to maintain order at the stop and look after the children	5
	Need a water machine at the stop	2
	Clean environment	2
Dedicated bus station	For parents and children	2

4   Discussion and Conclusion

Based on the results of the research, currently in China, parents who have children attending kindergartens, usually spend more than five minutes waiting for the bus. When waiting for a bus with their children, most parents and children will do other things, such as playing, using mobile phones and reading, chatting with their children instead of concentrating on waiting for the bus. Most parents of children prefer to use private cars and other means they can control, such as bicycles and e-bikes, to transport their children to kindergarten. According to the mutual verification of question 1 and question 3, only a small number of people choose public transportation when they are with their children. This could explain why less than half of parents think the current bus stops are inappropriate. They believe that inappropriate issues cover three issues: safety, location and experience design. Most parents don't think the current bus station design can protect their children. They argue that unreasonable factors for protecting children's safety in current bus station design, including a dedicated way, fence, platform, waiting area, departure area and experience design. They mentioned the problem of waiting at bus stops with their children. These problems are about parent, children, other passengers, bus stop, bus, environment. Most parents would like to have bus stops specially designed for their children. They further gave the things that are need to be added into bus stop to help with safety and comfort for children, such as platform, roof, seat, guardrail, information board, waiting area, boarding area, experience, and dedicated bus station. Hence, based on the result of the study, a usability experience bus stop design potential framework for children close to kindergarten in community transportation design is proposed as shown in Fig. 11, in terms of experience design, where the nine factors need to be considered when designing bus stop to help with safety and comfort for children in line with problems and factors: the four problems when waiting for the bus with children at the bus stop, the three inappropriate factors of the current bus stop, and the six inappropriate factors for protection of children safety in the current bus stop design. Further study will look into design in line with results of this study and validate a bus stop for a kindergarten.

Fig. 11. The usability experience bus stop design potential framework for children close to kindergarten in community transportation design (devised by the authors).

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