Can Internet be an effective way to conduct sex education for young people in China?

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Objective To promote adolescents and young people to learn sex related knowledge on Internet, and evaluate the effectiveness of sex education conducted.

Methods
This was an Internet-based intervention study of sex and reproductive health education. Two high schools and four colleges of a university in Shanghai were selected as the research sites. One high school and two colleges were chosen as the intervention group, the other school and two colleges as the control group. The intervention lasted 10 months (March 2003 through December 2003) and the education was provided through the website (www.youthhood.com.cn) on Internet, with web pages, online educational videos, Bulletin Board System (BBS) and expert mailbox. The website offered sexual and reproductive health knowledge/information (including sexual physiology and psychology, sexual morals, interpersonal relationship, love and marriage, STDs/HIV/AIDS, reproduction and contraception, premarital sex and pregnancy, induced abortion, sexual harassment, smoking and drug use etc.), service information, counseling and discussion on sex-related issues for all grade one students in the intervention group. Only subjects in the intervention group, who were provided private usernames and passwords, could browse the website. No special sexual education was given to the students in the control group. Baseline survey was conducted in both groups prior to the implementation of the intervention, then similar survey was conducted in both groups after the intervention. Totally, 624 students from the intervention school/colleges, and 713 from the control school/colleges enrolled, and about 97.2% of these were re-interviewed at follow-up. The impact of the intervention was evaluated by comparing the changes of students' sex and reproductive health knowledge, attitudes and behaviors between the baseline and post-intervention surveys and between the intervention and control groups. Survey data were entered with EpiInfo 6.04 and analyzed with SAS 8.01.

Findings Baseline survey showed that 90.0% of subjects ever surfed Internet and two thirds (67.8%) thought it was a good way to carry out sex education on Internet. More than 80% of subjects reported that they benefited from the web site and about half reported the website promoted them to pay attention to reproductive health knowledge or learn the knowledge from other sources at post-intervention survey. At baseline, the median scores of reproductive health knowledge in the intervention and control groups were about 50.0 and no significant differences were found between two groups ($p>0.05$). After intervention, the score in the

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intervention group increased to 63.4, and it was significantly higher than that in the control group (55.1). In terms of each type of knowledge (reproduction, contraception, condom, STDs and HIV/AIDS), all of 5 types' scores in the intervention group were significantly higher than those in the control group at post-intervention ($p<0.0001$) while no significant differences were observed between them at baseline ($p>0.05$). Group × time interaction effects were found in ordinal logistic regression analysis on knowledge scores ($p<0.001$), indicating the intervention increased subjects' knowledge significantly. After classified by type of subjects, group × time interaction effect on attitude towards sex-related issues was found among high school students (OR=0.628, 95%CI:0.398-0.991), suggesting the intervention might change the attitude of high school students and make their attitude towards sex more conservative. Results also showed that the intervention had positive influence on young people's attitude towards providing contraceptive service for the unmarried. However, no differences of sex-related behaviors were observed between two groups both at baseline and post-intervention surveys in this study.

Conclusions Providing sex education through Internet was highly feasible. Internet –based sex education program increased students' reproductive health knowledge effectively, and made high school students' attitude towards sex more positive.

Keywords Adolescent; Unmarried youth; Sex education; Intervention; Internet-based; China

Introduction

With rapid modernization and economic expansion, and more exposure to media, the attitude of Chinese adolescents and youth towards sex are becoming much more liberal. More and more young people have sex before marriage, and the age at debut is declining [1]. However, adolescents and young people lack basic reproductive health knowledge and skills to prevent the adverse health consequences of premarital sex [1]. As a result, there has been a marked increase in the number of unplanned pregnancy and induced abortion among unmarried young people [2,3,4,5]. There is also an upsurge in the incidence of sexually transmitted diseases (STDs) and HIV infection [6,7].

Education must be the first choice to increase their knowledge and capacity of self- protection. Actually, Chinese government has realized the importance of sex education among adolescents since 1980s. The sex education, which is called puberty education in schools, was tested firstly in several middle schools in early 1980s and was conducted in 90% of middle schools by the end of 1980s in Shanghai. In the country, puberty education covered all middle schools in the early 1990s. At present, puberty education has been put into the curriculum of middle schools in Shanghai and in some other cities/provinces of the country. However, being affected by the traditional culture and the competition for students to enter key senior middle schools or universities, sex education in schools is ignored to a considerable extent. The contents of the education are superficial and cann't meet students' real needs, and the manners can't attract students' attention and upsurge their interests. So adolescents learnt few of sex and reproductive health knowledge from schools. The sexual and reproductive health

knowledge adolescents and young people have had was mainly obtained from media, such books and periodicals, magazines, movies and television. A study conducted among unmarried people who would be married soon in Shanghai showed that 44.4% of women got their reproductive health knowledge from books, newspapers, movies and television[8] A study conducted among middle school students indicated that 72.3% and 69.4% got knowledge about puberty from books/periodicals/newspapers and television, respectively[9]. Among unmarried youth aged 18-24, the three leading information sources for contraception are books/newspapers/magazines (84.3%), television (58.9%) and relatives/friends (24.1%) [10]. For university students, the main sources of their knowledge on HIV/AIDS were newspapers/periodicals/magazines (89.4%), out-of-school books (70.2%) and television (65.9%)[11]. Therefore, media has become one of the most important sources of reproduction health knowledge of adolescents and unmarried youth.

Presently, Internet is an important part of the Chinese media. Current data showed by middle of 2004, 87 million people surfed Internet in the country, and 54.1% of them are under 25 years old. In the large cities of the country, the proportion of adolescents and youth accessing Internet is most high. In Shanghai, according to a small "market investigation" on the availability/ownership and use of computers and Internet, which we conducted in one middle school and one college in December 2001 before the program implemented, 73% of college students' families had computers, and 79% of fresh college students and 72% of middle school students had ever visited Internet at home or Internet cafe respectively. Nearly 60% of college students reported that they spent more than 3 hours a week on Internet. Around 40% said they have visited a website to obtain sex-related knowledge, and 75% believed it was necessary to establish a website for sex education. This data suggest that Internet can be a powerful influence on young people's study and everyday life, and might be a primary channel for acquiring sex and reproductive health information in China.

There have been some well-designed websites which are relevant t or focus on adolescent sex and reproductive health education, set up by some projects or institutions out of China. However, these websites use English language only. Some Chinese reproductive health websites have also a broad coverage on family planning and reproductive health knowledge, but few of them focused on adolescents or covered some important knowledge and information that adolescents and young people need. In addition, there are no rigorous studies about the effect of sex education by Internet in China at present. Therefore, it is necessary to design and implement a website of sex education with local language especially for adolescents and unmarried youth, providing scientific, rich, attractive and meaningful sex and reproductive health knowledge and related information, and to evaluate the effectiveness of the website on increasing adolescents' and young people's knowledge and changing their attitudes and behaviors.

Methods

The study project was approved by the Scientific and Ethical Review Group (SERG), Department of Reproductive Health and Research, WHO.

Study design

Two high schools and four colleges of a university in Shanghai were selected as the research sites. One high school and two colleges were chosen as the intervention group, the other school and two colleges as the control group. The criteria for the selection included: (a) students were accessible to Internet in school/college; (b) schools and colleges in the intervention and control groups were comparable at educational level and students' source or family background; (c) schools'/colleges' authorities supported the intervention program. To insure comparability, the two high schools were selected from the same district and four colleges from one science and engineering university. All the fresh students in the selected high schools and colleges were recruited as the subjects. Baseline survey was conducted among the subjects before initiation of the intervention in February 2003. A similar survey was conducted in both groups after 10 months' intervention. Total 1,337 subjects were recruited to participate in the baseline survey, among whom 624 were in the intervention group and 713 in the control group. A total of 97.2% were successfully followed up 10 months after the initial intervention, including 96.6% from the intervention group, and 97.8% from the control group. The survey was conducted by self-administered questionnaires. Trained interviewers assisted respondents, where necessary, in understanding questions with which they might have difficulties. All completed questionnaires were reviewed by research staff for completeness and consistency.

Intervention

Intervention activities were conducted by a specifically designed website (www.youthhood.com.cn), which offered sexual and reproductive health knowledge, counseling and service information related to sexuality and reproduction. Only subjects in the intervention group, who were provided private usernames and passwords, could browse the website. No special sexual education was given to the students in the control group. The intervention lasted 10 months (March 2003 through December 2003) and comprised four measures of activities: (a) Provision of sex and reproductive health knowledge and services information by webpages. This was the main intervention activity. There were more than two hundreds webpages in the website, with a lot of vivid pictures and animations welcomed by adolescents and young people. Knowledge and information on sex physiology and psychology, sexual morals, relationship, love and marriage, STDs/HIV/AIDS, reproduction and contraception, premarital sex and pregnancy, induced abortion, sexual harassment, etc. were provided through these webpages. Information was also provided on how and where to access reproductive health services. (b) Provision of professional counseling by email message. A well-trained counselor was responsible for responding young people's email as well as their questions posted on the BBS. (c) Discussions on the BBS. Subjects could discuss sex related issues on BBS to get each other's opinion. A member of the research team involved in discussions, leading the discussion if the discussion went far away from the topics. (d) Video shows on the website. Totally ten educational videos were attached on the website. These videos provided knowledge on sexual physiology, self-protection, contraception and pregnancy, consequence of unprotected intercourse, harm of induced abortion and the prevention of STDs/HIV/AIDS. The website was updated every two weeks. To make the

website be attractive to students, suggestions of them were adopted during design of the website and modification was made according to the information from baseline survey and feedback during the intervention. Moreover, students interested in web design in the intervention group were encouraged to involve by providing educational materials.

Measures

There were two main measures (i.e., a. knowledge score and b. attitude score). a. There were 98 questions on the knowledge of reproduction, contraceptives, condom, STDs and HIV/AIDS in the questionnaire. For each question, one point was given if answered correctly and zero to the others. The original score was converted into a new score with the maximum of 100. The total knowledge score and scores of reproduction, contraceptives, condom, STDs and HIV/AIDS were calculated respectively based on the corresponding questions, which were used to evaluate subjects' knowledge level. The higher the points were, the more their knowledge was. b. There were 8 statements on the attitudes to sex-related issues in the questionnaire. They were split into two groups. The first group included the statements of "There is nothing wrong for unmarried boys and girls to have sexual intercourse if they love each other", "It's all right for boys and girls to have sex with each other provided that they use contraceptive methods to prevent pregnancy" and "'One night sex' is acceptable". For each statement, 3 points was given if agreed and 1 or 2 to disagreed or unsure. The second type included the statements of "Most boys who have sex before marriage regret it afterwards", "Most girls who have sex before marriage regret it afterwards", "You would look down on him/her, if your boyfriend/girlfriend have had sexual intercourse with other people before meeting you", "Girls should remain virgins until they marry" and "Boys should remain virgins until they marry". Subjects agreed with these statements scored 1 point, disagree scored 3 points and unsure score 2 points. The total points for these statements were used to represent subjects' sex-related attitude. The higher the point was, the opener the attitude was.

Statistical analyses

Data for this paper analyzed and compared findings at two points (baseline and post-intervention) in two groups (the intervention group and the control group). Differences of percentage distributions between two groups in categorical variables were examined with Chi-square tests. For non-normal distribution data such as knowledge score, nonparametric statistics, i.e. Wilcoxon-Mann-Whitney test was used. The effects of the intervention on reproductive health knowledge and sex-related attitude were analyzed using ordinal logistic regression models (the knowledge and attitude scores or the dependent variables of the models were ordered as four categories by quartiles) adjusting the potential factors. The effect of the intervention on sex-related behaviors was analyzed using binary logistic regression model (considering the quite low sex-related behaviors among subjects, four types of behaviors including hugging, kissing, petting and sex intercourse were combined into one indicator as the dependent variable of the model, where 0 for none of all these behaviors and 1 for others). Data were entered twice with EpiInfo 6.04 software, and then validated until two inputs were completely the same. They were analyzed with SAS 8.01.

Results

Profiles of participants

The socio-demographic profile of students involved in both the intervention and control groups is presented in Table 1. Most of the socio-demographic characteristics of two groups were similar. No significant differences were observed in type of subjects (high school or college students), age distribution, having a single room or not, father's education level, family economic status and family monitoring between the intervention and control groups. Differences were observed in terms of place that college students came from, mother's education level and parents' occupations. Subjects from the intervention group tended to come from out-of-Shanghai, and their mother would be more likely to have a higher education level, and their parents to be farmers than those from the control group. Gender disparities were also observed: there were more high school students among females than that among males in both groups; in control group, females tended to be younger, their parents' education level was higher (senior high or more) and their family economic status were better than were males.

Table 1 Socio-demographic profile of participants at baseline: intervention and control groups (%)

Characteristics	Intervention group				Control group				P* (interv.-control)
	Total (n=624)	Male (n=376)	Female (n=248)	p*	Total (n=713)	Male (n=360)	Female (n=353)	p*	
Type of subject									
High school student	44.6	40.4	50.8	0.0107	49.1	44.2	54.1	0.0079	0.0972
College student	55.4	59.6	49.2		50.9	55.8	45.9		
Age (years)									
⩽15	20.7	17.5	25.4	0.1114	20.6	17.5	23.8	0.0074	0.2417
16	22.9	22.1	24.2		27.8	26.1	29.5		
17	2.6	2.7	2.4		2.00	1.9	2.00		
18	20.2	21.3	18.6		20.2	18.9	21.5		
⩾19	33.6	36.4	29.4		29.5	35.6	23.2		
Place subject came from @									
Shanghai	45.4	45.5	45.1	0.9354	57.3	57.2	57.4	0.9704	0.0015
Others	54.6	54.5	54.9		42.7	42.8	42.6		
Having a single room or not									
Yes	71.8	73.1	69.8	0.3585	73.2	72.8	73.6	0.7916	0.5625
No	28.2	26.9	30.2		26.8	27.2	26.4		
Father's education level									
Junior high or below	33.2	34.8	30.6	0.7356	32.4	36.9	27.8	0.0329	0.8316
Senior high or technical school	44.7	43.6	46.4		47.1	41.9	52.3		
Junior college or above	20.3	20.0	21.0		19.0	19.4	18.5		
Unknown	1.8	1.6	2.0		1.5	1.7	1.4		
Mother's education level									
Junior high or below	42.5	44.2	39.9	0.1489	34.8	40.6	28.9	0.0035	0.0214
Senior high or technical school	45.8	42.5	50.8		53.0	47.5	58.6		
Junior college or above	10.6	12.2	8.1		10.4	9.4	11.3		
Unknown	1.1	1.1	1.2		1.8	2.5	1.1		
Father's occupation									
Worker#	53.4	54.0	52.4	0.3744	59.9	60.3	59.5	0.8832	0.0022
Farmer	7.0	8.2	5.2		3.0	3.3	2.6		
Professional personnel	7.7	6.7	9.3		7.5	8.1	6.8		
Administrative personnel	20.7	19.4	22.6		21.2	20.3	22.2		
Individual or private enterprise owner	11.2	11.7	10.5		8.4	8.1	8.8		
Mother's occupation									

Worker[#]	61.6	53.2	58.7	0.0610	67.7	70.6	64.9	0.1468	0.0196
Farmer	9.0	10.9	6.1		4.8	5.6	4.0		
Professional personnel	9.5	8.5	10.9		8.1	8.1	8.2		
Administrative personnel	13.3	12.2	14.9		12.3	10.6	14.2		
Individual or private enterprise owner	6.6	8.0	4.4		7.0	5.3	8.8		
Family economic status									
Good	13.0	12.5	13.7	0.2845	14.2	11.9	16.5	0.0238	0.4739
Medium	69.5	68.1	71.8		70.6	69.7	71.6		
Bad	17.5	19.4	14.5		15.2	18.3	11.9		
Family monitoring									
Severe	41.3	41.2	41.3	0.5164	41.3	40.3	42.3	0.8457	0.8800
Medium	42.7	44.2	40.9		41.9	42.8	40.9		
Lenient	15.9	14.6	17.8		16.8	16.9	16.8		

*: χ^2 test between males and females or between the intervention and control groups

[@]: only for college students

[#]: including retiree, the jobless, etc.

Internet use of participants at baseline

A proportion of 90.0% of subjects had ever surfed Internet (87.7% in the intervention group and 92.0% in the control group). The three leading places that students accessed Internet were home (39.3%), Internet cafe (33.8%) and school (23.1%). About two thirds (74.7%) of the subjects surfed Internet more than one hour every time. The three leading purposes for surfing Internet were chatting (51.1%), watching movies or listening songs (41.7%) and playing games (37.9%). More than one third (37.4%) of subjects had browsed reproductive health knowledge on Internet, and about 5% of them browsed this type of websites more than one time per month. Their opinions on these websites were focused on unsystematic of the contents (44.4%), pornographic (43.8%), inappropriate to adolescents/young people (37.8%) and unscientific (24.2%). A proportion of 33.7% of subjects had visited pornographic websites, and 8.2% of them browsed these websites more than one time per month. Most of students recognized these websites were harmful to them, but 30% considered they were attractive. Two thirds (67.8%) of subjects thought it was a good way to carry out sex education program on Internet (Table 2).

Table 2 Internet use of participants at baseline (%)

Internet use	Total (n=1337)	Intervention group			Control group			p* (interv.-control)
		Total (n=624)	Male (n=376)	Female (n=248)	Total (n=713)	Male (n=360)	Female (n=353)	
Having surfed Internet or not								
Yes	90.0	87.7	90.0	84.3	92.0	93.3	90.6	0.0083
No	10.0	12.3	10.0	15.7	8.0	6.7	9.4	
Time of Internet use[@]								
≥1 hour	74.6	75.4	78.6	70.2	74.0	79.3	68.4	0.5772
<1 hour	25.4	24.6	21.4	29.8	26.0	20.7	31. 6	
Having browsed RH knowledge or not								
Yes	33.7	34.8	45.7	18.2	32.7	46.4	18.6	0.4183
No	66.3	65.2	54.3	81.8	67.3	53.6	81.4	
Times of browsing RH knowledge[@]								
≥1 times per month	4.9	5.1	5.2	4.4	4.7	5.4	3.0	0.8641
<1 time per month	95.1	94.9	94.8	95.6	95.3	94.6	97.0	
Having browsed pornographic websites or not								

Yes	30.3	31.9	54.73	6.70	28.9	48.6	8.8	0.2338
No	69.7	68.1	45.27	93.30	71.1	51.4	91.2	
Times of browsing pornographic websites[@]								
⩾1 time per month	8.2	8.0	8.6	0.0	8.3	9.7	0.0	0.9378
<1 time per month	91.8	92.0	91.4	100.0	91.7	90.3	100.0	
Is it a good way to conduct sex education on Internet?								
Yes	67.8	69.7	70.2	68.9	66.1	70.6	61.5	0.1540
No	32.2	30.3	29.8	31.1	33.9	29.4	38.5	

Note: RH: reproductive health

*: χ^2 test between the intervention and control groups

[@]: only for those who answered "Yes" to the above question

Exposure and evaluation to intervention

During 10 months of the intervention, there were 15,357 clicks on the intervention website. Subjects' participation and evaluation are showed in Table 3. Most (94%) of subjects in the intervention group had browsed the website. Among them 61.1% browsed 1-4 times per month, and 5.7% more than 5 times per month. About 40% of subjects spent more than 20 minutes or 10-20 minutes on the website every time respectively. More than 80% of subjects reported that they benefited from the website. About 95% of subjects thought the contents of the website was appropriate to adolescents/youth at his/her age. Also 86% of subjects evaluated the layout of the website well or very well. The website had also promoted about half of subjects to pay attention to RH knowledge or learn the knowledge from other sources. No significant differences were observed between male and female participants. However, females gave the website more positive comments than males.

Table 3 Participation and evaluation to the intervention activities (%)

Participation and evaluation	Total (n=624)	Male (n=376)	Female (n=248)	p*
Times of browsing the website				
⩾5 times per month	5.7	6.5	4.5	0.4484
1-4 times per month	61.1	59.8	63.3	
<1 times per month	26.9	26.4	27.3	
Never	6.3	7.3	4.9	
Time of spending on the website every time[@]				
⩾20 minutes	39.9	40.9	38.6	0.8555
10-20 minutes	43.8	43.0	45.1	
<10 minutes	16.3	16.1	16.3	
Benefit from the website [@]				
Great	13.5	12.7	14.7	0.0250
Some	69.8	67.0	73.7	
Nothing	16.7	20.3	11.6	
Contents of the website are appropriate to youth or not[@]				
Very appropriate / appropriate	94.7	92.7	97.4	0.0145
Inappropriate	5.3	7.3	2.6	
Layout of the website [@]				
Very good /good	86.5	82.7	91.9	0.0018
No so good	8.2	9.4	6.4	
Bad	5.3	7.9	1.7	
Being promoted by the website to pay attention to RH knowledge or not[@]				
Yes	53.3	50.8	56.7	0.1557
No	46.7	49.2	43.3	

Being promoted by the website to obtain RH knowledge from other sources or not[@]				
Yes	40.6	42.0	38.8	0.4334
No	59.4	58.0	61.2	

*: χ^2 test between males and females

[@]: only for those who had visited the website

It was found that subjects who sought counseling by email was few (only 11 persons) and although there were 452 subjects who had registered on the BBS at the end of the intervention (the website was not open to public during the intervention period), only a few of them posted topics or comments on it. In the post-intervention survey, related questions were asked to explore the reasons. The results showed that the main reasons for non-use of the email were "no question to ask"(45.5%), "seldom use email"/"felt inconvenient to use email" (34.3%), "afraid privacy was released"(17.7%), and "resolved problems by myself"(16.3%). More than half of students (58.3%) only occasionally or never used email usually. With regard to the reasons for nonuse of the BBS, 63.7% of subjects contributed to "Members on the BBS were too little so there was no atmosphere of discussion ", 18.1% to "Contents of the BBS was too little", 15.6% to "Time spending on Internet was limited" and 14.1% to "unable to or seldom logged on BBS". There were 71.9% of subjects who occasionally or never logged on BBS.

Effectiveness of intervention

a. Knowledge

Subjects' sex and reproductive health knowledge level was expressed by knowledge scores in this paper (see **Measures**). Table 4 shows that the median scores of total knowledge in the intervention and control groups at baseline were about 50.0 points and no significant differences were found between two groups ($p>0.05$). However, at the post-intervention survey the total score of subjects in the intervention group increased to 63.4, which was significantly higher than the score of subjects in the control group (55.1). The increase of the score from baseline to post-intervention in the intervention group (14.4) was 2.8 times of that in the control group (5.10). In terms of the type of knowledge, all of 5 types' scores in the intervention group were significantly higher than those in the control group at post-intervention ($p<0.0001$) while no significant differences were observed between them at baseline also ($p>0.05$). Males and females showed similar changes, although there were significant differences for most of the scores between them.

Table 4 Knowledge scores at baseline and post-intervention in the intervention and control groups (Median)

Knowledge	Intervention group			Control group		
	Total	Male	Female	Total	Male	Female
Reproduction						
Baseline	54.6	59.1	54.6	54.6	63.6	54.6
Post-intervention	81.8*	81.8*	81.8*	63.6	63,6	63.6
Contraception						
Baseline	24.2	27.3	18.2	21.2	24.2	21.2
Post-intervention	48.5*	51.5*	42.4*	30.3	30.3	27.3

Condom						
Baseline	66.7	66.7	55.6	66.7	66.7	55.6
Post-intervention	88.9*	88.9*	77.8*	66.7	66.7	66.7
STDs						
Baseline	48.2	55.6	44.4	51.8	55.6	44.4
Post-intervention	70.4*	77.8*	63.00*	55.6	59.3	51.8
HIV/AIDS						
Baseline	85.0	85.0	82.5	85.0	85.0	85.0
Post-intervention	90.0*	90.0*	90.0*	85.0	85.0	85.0
Total						
Baseline	49.0	53.1	43.9	50.0	54.1	45.9
Post-intervention	63.4*	71.4*	64.3*	55.1	57.1	53.1

*：P<0.0001,Wilcoxon test between the intervention and control groups

Group×time interaction effect was found on total reproductive health knowledge score in ordinal logistic regression analysis (the reproductive health knowledge score or the dependent variable of the model was ordered as four categories by quartiles from low to high) indicated the intervention activities had effect on reproductive health knowledge of young people, i.e. the intervention increased youth knowledge significantly (Table 5). The logistic regression analysis also showed that the reproductive health knowledge score was not associated with gender, parents' education level and family economic status. However, their knowledge score was correlated with being a high school student or college student, having browsing reproductive health knowledge on Internet (except the website "www.youthhood.com.cn") or not, having browsing pornographic websites or not and having discussed sex-related issues with father or friends. College students trended to have more reproductive health knowledge than high school students. Students who had browsed reproductive health knowledge on Internet or browsed pornographic websites and who had discussed sex-related issues with father or friends were likely to have more reproductive health knowledge. It was also showed that the intervention increased each of 5 types of knowledge significantly. Reproduction knowledge was increased by the intervention most obviously, with 10.651 of odds ratio (OR) (95%CI: 7.617 -14.8964, p<0.0001) for the group×time interaction effect, while the odds ratios for the knowledge of STDs, condom and HIV/AIDS were 2.213 (95% CI: 1.612-3.039, p<0.0001), 2.121 (95% CI: 1.540-2.921, p<0.0001) and 1.926 (95% CI: 1.404-2.641, p<0.0001) respectively. The minimum interaction effect of group×time was found on contraceptive knowledge, being 1.774 of odds ratio (95%CI: 1.292-2.438, p=0.0004).

Table 5 Ordinal logistic regression analysis of total reproductive health knowledge score*

Variables	OR	95%CI	p
Group (intervention vs. control)	1.082	0.869-1.348	0.4795
Time (post-intervention vs. baseline)	2.393	1.922-2.980	<0.0001
Group×time	2.847	2.060-3.933	<0.0001

*: Adjusted gender, type of subjects, parents' education level, parents' occupation, family economic status, having browsed reproductive health knowledge on Internet or not, having browsed pornographic websites or not, having discussed sex-related issues with parents or friends or not.

b. Attitude

Based-on subjects' attitude score (described in **Measures**), ordinal logistic regression analysis was used to evaluate the effectiveness of the intervention on subjects' attitude towards sex (the attitude scores or the dependent variables of the models were ordered by quartiles from low to high). Table 6 showed that no group×time interaction effect was found on the attitude when combination of high school students and college students (OR=0.793, 95%CI: 0.582-1.080). After classified by type of subjects, group×time interaction effect on attitude was found among high school students (OR=0.628, 95%CI: 0.398-0.991). The result indicated that the intervention might change high school students' attitude and make their attitude towards sex-related issues more conservative. However, the significance was marginal (Table 6).

Table 6 Logistic regression analysis of sex-related attitudes*

Variables	Total			High school students			College students		
	OR	95%CI	p	OR	95%CI	p	OR	95%CI	p
Group (intervention vs. control)	1.220	0.986-1.509	0.0675	1.124	0.812-1.555	0.4818	0.973	0.693-1.364	0.8721
Time(post-intervention vs. baseline)	1.760	1.424-2.175	<0.0001	1.934	1.356-2.758	0.0003	1.933	1.408-2.652	<0.0001
Group×time	0.793	0.582-1.080	0.1405	0.628	0.398-0.991	0.0459	0.781	0.485-1.259	0.3100

*：Adjusted gender, type of subjects (for the total model), parents' education level, parents' occupation, family economic status, having browsed reproductive health knowledge on Internet or not, having browsed pornographic websites or not, having discussed sex-related issues with parents or friends or not.

For the attitude to providing contraceptives to unmarred youth, 49.9% of subjects in the control group and 51.4% in the intervention group disagreed the statement that "Providing contraceptives for young people means encouraging them to have sex" at baseline and no difference was observed between two groups ($p>0.05$). The proportions increased in both the control and intervention groups after intervention period, but the increase in the intervention group was significantly higher than that in the control group (63.9% and 56.0% respectively, $p<0.01$). The results indicated that the intervention might change young people's attitude towards the provision of contraceptive service for the unmarried and make their attitude more positive.

Compared with the change of knowledge and attitude, change of behaviors are always more difficult. In this study, no differences of sex-related behaviors including hugging, kissing, petting and sex intercourse were observed between two groups both at baseline and post-intervention surveys ($\chi 2$ test, $p>0.05$ respectively). Binary logistic regression analysis also showed that group×time interaction effect on students' sex-related behaviors was not significant (OR=0.978, 95%CI: 0.695-1.375, p=0.8975).

Discussion

Provision of sex education through Internet brings tremendous challenges to traditional education and the space of education. This has broken with the traditional pattern of communication between the students on one side and the schools and families on the other. The degree of self-choice by adolescents has correspondingly increased. Information on those

sensitive or private sex-related questions that youth reluctant to raise with their parents and teachers can be obtained from Internet therefore. Compared with face-to-face counseling and discussing with experts and peers, and watching educational video in the cinema, sex education on Internet is much more privacy, and adolescents and young people can feel much more relaxed to learn what their real need. This meets their psychological needs of keeping secret and independence. The above advantages of Internet and young people's preference to this new learning route determine that it would be feasible to carry out sex education on Internet. Finding present in this paper provide the evidence that this education style is well accepted and welcomed by high school and university students and provision of sex education though Internet is highly feasible.

It can be concluded from the study that the Internet intervention education program increased students' reproductive health knowledge effectively and it also had minor influence on their attitudes towards sex-related issues. The results are consistent with a growing body of evidence from other school- and community-based intervention studies on sex and reproductive health education conducted in the country[12-14] and proved Internet can be a effective way to conduct the education. However, although behavior change is the finally aim of any education programs, this study did not provide the evidence that the intervention program changed subjects' sex-related behaviors, as other studies showed [15]. Several possibly reasons are considered as follows. Firstly, as behavior's change needs a relative long process while the invention only lasted for short period and the evaluation was taken just after the completion of the intervention, the intervention could not show its effect at present. Secondly, the original study was designed to evaluate the effects of the intervention on subjects' knowledge and attitude, so the sample of the study was not big enough for observing the change of behaviors with low frequency. Thirdly, the education intension was not strong enough as the intervention of this study was only last ten months. It is suggested that studies with long period to address behavior change should be conducted.

The intervention program has been proved successful not only by the above-mentioned results but also by the feedback from the public later. The website set up in the study has open to public since the completion of the study in April 2004. It is very welcomed by not only adolescents, but also schools' teachers and adolescents' parents. Local education department has planned to combine the website with "Life Education" in middle schools. Moreover, it attracted media to give a serious of reports. Totally near 20 national and local newspapers have reported the website, and national and local TV stations have made special program and report on it. The three main newspapers of Shanghai - *Jie Fang Daily* , *Wen Hui Bao* and *Xin Ming Evening Newspaper* have all reported the website with titles such as "Talk privates to unseen teacher", "No obstacle to obtain sex related knowledge" and "Establish positive life value" etc. It is also noteworthy that people who sent email to expert for counseling and posted on the BBS increased significantly after its open to public, especially the BBS where more than 2000 persons who have registered at present.

The intervention has been designed to provide sex and reproductive health education by Internet, with web pages, online educational videos, Bulletin Board System (BBS) and expert

mailbox. At baseline survey, “expert email” was cited by more than half of subjects (54%) as a favorite method to obtain reproductive health knowledge and “online discussion” by 30%. However, only a few subjects in the intervention group actually sent email to expert and posted on the BBS during the intervention. As the reasons for non-use of the email and the BBS are obvious as reported in the post-intervention survey, it is indicated that the difference between the favorite and actual use, which depend on the real needs and the accessibility of the method, and the amount of the target population, should be taken into account when designing a program.

Adolescent sex education in China is still controversial and disputed. At the time the study was conducted, the disputed issue was not whether the education should be provided but what kind of sex and reproductive health education and service should be provided and how they should be provided[16]. In recent years, adolescent sex education in Shanghai has attracted greater interest of local authorities, academic institutions, NGOs and other social organizations, but there is not a systematic, complete and comprehensive program of it, neither is there adequate awareness of responsibility or action from society. The increase of problems concerning youth sex and reproductive health calls for innovation and improvement in relevant education and services. Among variety of efforts being made, sex education through Internet provides another possible solution. Therefore, while the Internet is developing rapidly in China, it should be promoted to use Internet for adolescents’ sex and reproductive health education, especially in these places where well-trained educators or trainers for sex education are not available at present. Considering the wide spread of information on the Internet, the number of the websites providing sex and reproductive health education need not too many. The experience of this intervention suggested that, in order to build a qualified comprehensive education website which provide information, knowledge and counseling service, people from related fields and departments including educational experts, school teachers, research staffs, service providers, network engineers shall work together. The website shall be authoritative, lively and fit for the taste of adolescents. The website shall be also constructed in such a manner that attracts attention and involvement of adults, so that it could be an invisible platform on which adolescents and adults including parents and teachers can freely communicate, and both the communication among adolescents and between adolescents and adults can be promoted.

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