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Mobile IPTV: Implications for Education

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ABSTRACT

Mobile IPTV (Internet Protocol Television) provides digital content which users watch as a television broadcast via the Internet on a mobile device. This paper presents the development of IPTV, Suan Dusit Internet Broadcasting, (SDIB) to mobile IPTV and discusses the implications for education. Mobile IPTV was developed as a prototype and designed to support users via wireless and mobile networks regardless of the mobile device. The system can be broadcasted through both live and video on demand (VOD) utilizing a mobile browser (smart phones, smart TVs, and tablets) and web browsers (Windows, Mac, and UNIX). The mobile IPTV prototype has been used and evaluated in this study. The results of student's behavior when using mobile phones in their learning found that the highest mobile use was for Facebook and Line to communicate and share information with their classmates. The results of student's attitudes towards using mobile phones in their learning found that the highest mobile use was for sharing information with classmates, sharing learning experiences on social networks, and using mobile phones to support their studies. The result of the IPTV and mobile IPTV system evaluation found that overall mobile IPTV had a higher user satisfaction than IPTV. Furthermore, mobile IPTV creates a good learning experience for the users. This paper provides guidelines in technical issues for helping educational institutions to develop mobile IPTV for education.

Keywords

Mobile IPTV, IPTV, internet broadcasting, mobile learning, educational innovation

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INTRODUCTION

Internet Protocol Television (IPTV) is defined as multimedia content – including text, graphics, audio and video files – over an IP network to reach a large number of users. It is a combination of modern technologies in computing, networking and storage to deliver content through an Internet Protocol (IP) network [1]. IPTV has changed the way users' access information and entertainment. It has been utilized in multiple sectors such as business, entertainment, communication, healthcare and education. IPTV has been integrated with e-Learning systems as a tool for supporting learning in education [2].

An example of IPTV implication for education, such as Suan Dusit Internet Broadcasting (SDIB), aims to use IPTV to develop new educational innovations in order to support distance and life-long learning for students and to increase learning channels for the delivery of information and knowledge to local communities [3-4].The IPTV system broadcasts four channels: children, video on demand, variety and radio, with more than seven hundred programs transmitted both through live and video on demand via computers and set top boxes (STB). The IPTV system was used in 80 pilot schools in Thailand. The result of the IPTV system evaluation in the pilot schools was highly satisfactory. Finally, a strategic plan of using IPTV as an educational innovation was developed [3][5].

However, the successful deployment of the IPTV application and services essentially depends on a wide range of supporting new technologies [6]. Currently, mobile telecommunication has evolved at an incredible pace worldwide. In developing countries, mobile penetration rates have long reached 100% [7].This increases the number of users – along with their portable devices – that can access information anywhere and anytime. Mobile technologies have become more powerful and pervasive and increasingly therefore mobile applications have become more important. They are being used in communication, business and education. According to an IDC survey [8], 70% of organizations are currently deploying at least one mobile application [9].

Mobile technologies have several advantages such as context: the ability to acquire information about their learning environment presents a unique ability to personalize the learning opportunity. Mobility: learners can learn anywhere, anytime. Learning over time: lifelong learners especially need effective tools to organize and reflect via their mobile. Informality: the learner can use mobiles to search and share information more effectively during their learning process [20].

It will be a challenge to expanding IPTV to become mobile IPTV for supporting changing technology. Technology trends allow mobile IPTV to extend many IPTV services to mobile users [10–11]. Mobile IPTV technology is an application that allows users to transmit and receive multimedia content through an IP-based network with the support of security, mobility and interactivity [12]. Mobile IPTV refines mobile TV as an IP-based service that shifts content across anytime, anyplace and multiple devices [16].

There are four types of mobile TV technology approaches: mobile TV over IP, IPTV over mobile devices, cellular IPTV, and Internet IPTV [12]. Typical mobile IPTV architecture started from users receiving content via smart phones or wireless equipment. Technical challenges for developing mobile IPTV to be considered include heterogeneity of end-users' terminals and devices, wireless link bandwidths, wireless link radio characteristics, service coverage, middleware and scalable video coding, quality of service (QoS), quality of experience (QoE) and business issues [12-13].

Although mobile IPTV has been greatly researched in the areas of communication, networking, and human computer interfacing, little research has been done on how to apply it to educational environments [2][7][9][10][11][12][14]. Mobile technologies allow students to develop a personalized, learner-centered, situated, collaborative, ubiquitous and lifelong learning experience [13-14]. Mobile IPTV is an educational innovation that supports learning activities complementary to the range of instruments that teachers can employ in the educational system.

Mobile IPTV has several advantages in supporting teaching and learning such as students creating and sharing their own content [12–13], having more tools and functions to support their needs [18], ease of use and convenience [13], attractiveness to learn [2] and providing good quality content.

The aim of this paper is to study the development of IPTV (Suan Dusit Internet Broadcasting: SDIB) to mobile IPTV and the evaluation of implications of the mobile IPTV prototype in education.

RELATE WORK

Research on mobile IPTV was further developed from the IPTV of Suan Dusit Internet Broadcasting systems (SDIB). The IPTV has goals of increasing educational opportunities for students in rural areas and to support lifelong learning for adult education throughout Thailand. It broadcasts four channels twenty-four hours a day with the content being transmitted both as audio and video (live and video on demand) [3–4]. The IPTV system has been implemented and used in 80 pilot schools. The data of an evaluation of the IPTV system was collected from questionnaires and interviews. The results found that IPTV users were highly satisfied with the content, set top boxes, television LCD, and overall IPTV systems [5]. Finally, an IPTV strategy plan 2010–2015 was developed. Table 1 shows the SWOT analysis of the IPTV system [5].

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Table 1: SWOT analysis of IPTV system

	Strength		Weakness
S1	IPTV used high quality hardware with a good system performance. It also provided an SET TOP BOX and LCD for the pilot schools to use free of charge.	W1	The set top box price was high therefore there was a lack of funds to purchase and install the IPTV system at early childhood care centers.
S2	IPTV has a good quality and aesthetically pleasing website.	W2	Content management software is expensive therefore the university could not afford to purchase it.
S3	IPTV staff have a lot of experience and have worked at the university for a long time.	W3	IPTV staff lacked script writing skills, and needed to outsource for help.
S4	IPTV is a new educational innovation in Thailand which is beneficial for academics.	W4	There was a lack of feedback from users.
S5	IPTV had good network infrastructure which could support up to 10,000 users at the same time.	W5	Teachers at early childhood care centers had difficulty accessing the Internet which led to major problem using the SDIB system.
	Opportunities		**Threat**
O1	The price of ICT equipment is getting lower; therefore it is a good opportunity for the local government to invest in SDIB systems in the near future.	T1	The set top box which is an important piece of equipment used in the IPTV system is imported and is therefore expensive.
O2	Mobile applications support the IPTV system; therefore SDIB via mobile or smart phone should be developed.	T2	IPTV content management software is still not very affordable.
O3	IPTV staff are trained twice a year.	T3	There is a lot of competition between IT jobs such as producer and scrip writer to create high quality IPTV programs. Therefore, the university cannot afford to hire people for these positions.
O4	IPTV content is needed by teachers in primary schools and early childhood schools so that they can use it to support their teaching and learning.	T4	There is a limited number of IPTV staff to create new programs which are beneficial to early childhood education.
O5	Internet service providers have covered almost every province in Thailand and are affordable.	T5	There is still no 3G network in Thailand.

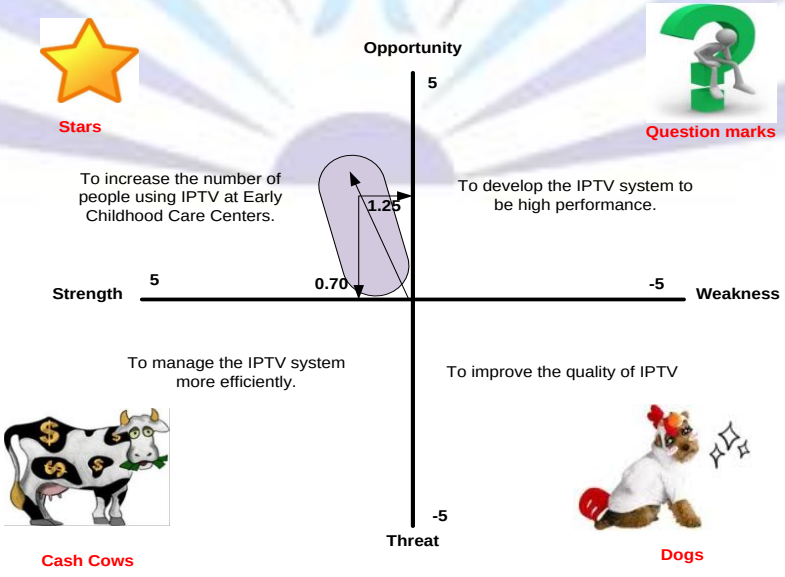

Figure 1: BCG Matrix of IPTV system

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IPTV Strategies

1. Organizational strategies

   - To increase the number of people using IPTV at early childhood care centers.
   - To manage the IPTV system more efficiently.
   - To improve the IPV system so it is high performance.
   - To improve the quality of IPTV.

2. Functional strategies:

   - To promote IPTV for teachers in early childhood centers so that they can use and utilize the knowledge gained.
   - To produce more early childhood programs.
   - To improve the management process in order for it to be of higher efficiency and quality.
   - To support research and development in IPTV in order for it to be of higher efficiency and quality.
   - To improve the quality of IPTV content.
   - To maintain IPTV equipment for prompt use.

3. There were 15 projects in the IPTV strategic plan:

   1. The acquisition of IPTV equipment by early childhood centers.
   2. To develop mobile IPTV applications for the iPad and smart phones.
   3. To develop the competency of IPTV staff, so that they can work using the One Stop Service.
   4. To publicize IPTV by using social networks and new media.
   5. To set up an IPTV call center to receive feedback from users.
   6. To broadcast IPTV via satellite.
   7. To acquire a high volume of set top boxes.
   8. To develop IPTV content management programs by using freeware.
   9. To implement the quality standard ISO9001:2008
   10. To hold a contest between students for SDIB programs or short movies
   11. To set up a set top box factory in Thailand.
   12. To promote more effective communication between IPTV users.
   13. To help IPTV users in rural areas to access the Internet via satellite.
   14. To outsource the IPTV program's scripts.
   15. To maintain IPTV equipment.

MOBILE IPTV DEVELOPMENT

Educational Framework

The mobile IPTV project was developed by expanding the IPTV system related to the strategy plan of IPTV. A Mobile IPTV system can be seen as part of a mobile learning system (m-Learning).

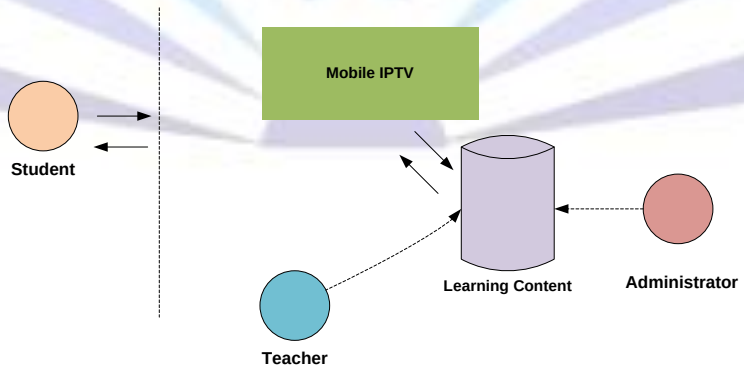

Figure 2: Mobile IPTV educational system model

Figure 2 depicts the architecture of an educational system model using a mobile IPTV system. During the educational process the student interacts with the teacher while simultaneously using mobile devices. The learning content is provided on a mobile IPTV system uploaded by a teacher or administrator.

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Mobile IPTV Concept

Mobile IPTV was designed to support senders and receivers. Currently, user created content (UCC) is becoming popular on the Internet, with any user being able to create their own content and provide it to the Mobile IPTV [10-11]. The mobile IPTV was designed to support a functional IPTV terminal device (e.g. smart phone, PDA, iPad, set top box) with information capabilities before delivering content. Moreover, it can deliver several optional versions to be selected according to the capabilities of the mobile equipment receiving the content (e.g. access rates, resolution, and supported formats) [10-11]. Mobile IPTV was designed to support four channels as with IPTV.

Prototyping

The mobile TV application was developed by following concepts of prototype [21]. Figure 3 shows the steps in prototyping mobile TV application development.

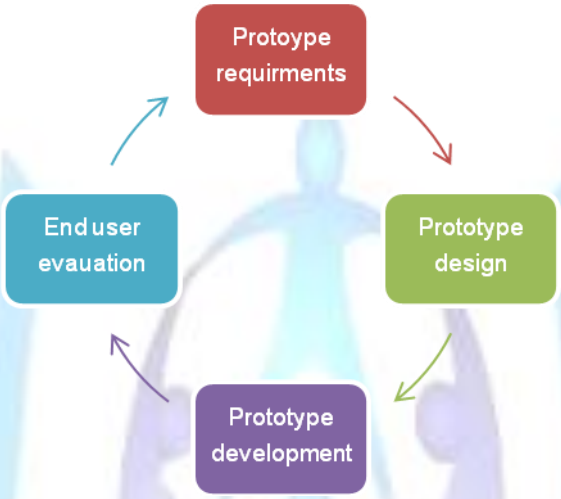

Figure 3: Mobile IPTV prototype

1. Prototype requirements identify the capability of the mobile IPTV system. It identifies user requirements by collecting data from interviewing students and teachers who will use the mobile broadcast system.
2. Design an initial prototype by using tools for a rapidly mobile broadcast application. This stage the mobile IPTV prototype considers how to deliver educational content and providing the functional requirement and usage workflow of the prototype.
3. Implement the mobile IPTV prototype to be used for 10 weeks by teachers and students.
4. End users evaluate the mobile IPTV prototype. The evaluation phase refers to feedback assessment and continuous improvement of the education process.

Users

Mobile IPTV has been designed to support various types of users as follows:

- Channel 1 (children): Users will be teachers in early childhood care centers around Thailand. Furthermore, the audience includes parents, kindergarten school teachers and researchers who are interested in studying early childhood education.
- Channel 2 (self-study): Users will be students who are studying at Suan Dusit Rajabhat University.
- Channel 3 (variety): Users will be students, teachers, university staff, and people who are interested in the programs.
- Channel 4 (radio): Users will be people who have low speed internet access.

Content

Content used for testing the mobile IPTV prototype from IPTV was created by users. Users of this prototype were teachers and 150 students who are studying strategic information planning for organizations at the Faculty of Science & Technology at Suan Dusit Rajabhat University during the first 10 weeks of semester one in the academic year 2013. Students produced content for their project developing strategic planning for the organization in video files. Teachers produced content, which connects to the mobile application, about a case study of strategic information systems in various types such as text, pictures, graphics, video and audio provided on the website.

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Screen design

Screens were designed for supporting wired mobile screens. Figure 4 shows an example of screen designs.

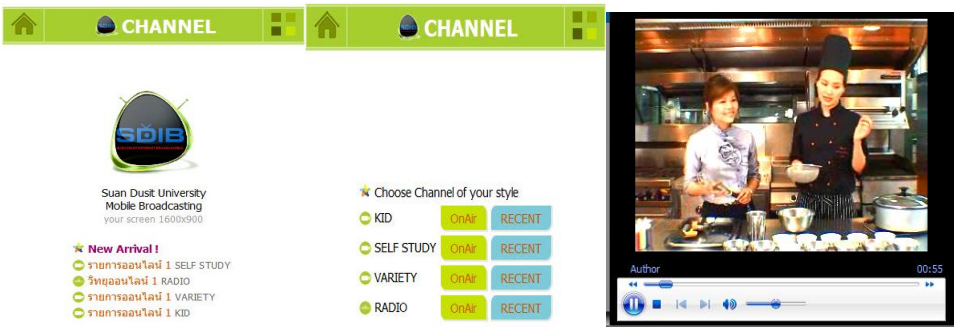

Figure 4: Example of Mobile IPTV screen design

The development of the mobile IPTV involves several technical issues [11] (shown in Table 2).

Table 2: Mobile IPTV system requirement

Feature	Requirement details	Prototype mobile IPTV
Content management	-Creates new content management systems which support bandwidth requests and congestion control capabilities.	-Creates new content management system.
IPTV content	-Delivers content in several optional versions to be selected according to the capabilities of the IPTV terminal receiving the content.	-The system supports content delivery in access rate, resolution and support formats. -Provides 4 channels -Users can create their own content and send it through the system.
IPTV terminal device	-Supports various types of terminal devices -Provides information regarding its bandwidth availability.	-Supports smart phone, PDA, iPad, smart TV -Provides information regarding bandwidth availability.
IPTV architecture	-Allows delivery of IPTV over different access networks. -Allows delivery of IPTV services to any devices.	-Allows delivery of IPTV over different access networks such as cable, optical, xDSL, and wireless. -Allows delivery of IPTV services of any mobile device such as smart phone, PDA, smart TV and set top box.

Development Tools

Mobile TV was designed using several tools that were integrated for development. Figure 5 shows the components of mobile IPTV that were constructed.

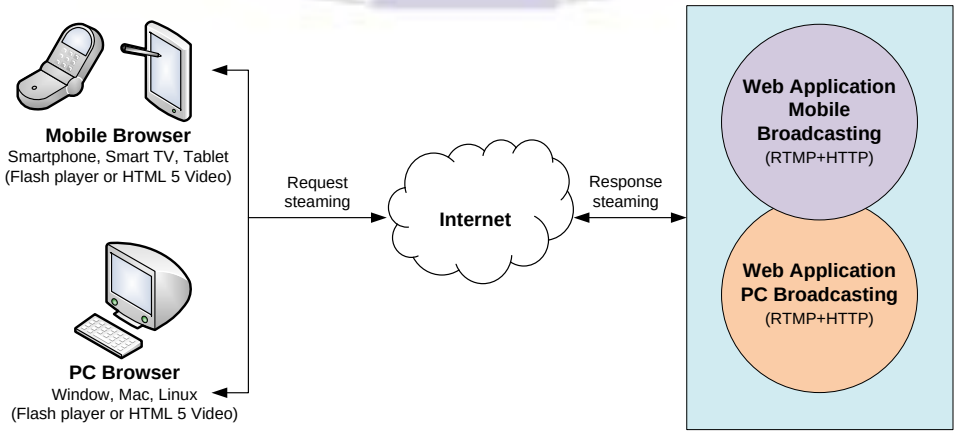

Figure 5: Mobile IPTV application structure

1. Device: the mobile IPTV application can be broadcast on PCs, tablets (iPad, Galaxy Tab, HP Touchpad), smart phones and smart TVs (iPhone, Samsung, BlackBerry, Nokia, HTC, Sony Internet TV)
2. Browser: an application used for connecting to the Internet. This mobile broadcast application was designed for supporting both browsers on PCs (Internet Explorer, Firefox, Safari, Chrome) and browsers on mobiles (Safari on iOS, Android, Internet Explorer Mobile). The mobile application supports HTML 5 and H.264 MGS [21], which are effective for TV video files. Moreover, the mobile TV was designed to support various types of displays.
3. Table 3 shows the system was designed for supporting both high and low quality video file types for mobile TV.
4. Table 4 shows the system was designed for supporting PC and mobile audio in single quality.

Table 3: Mobile video widescreen (16:9)

Quality	Width	Height	Audio Bit rate	Total Bit rate	Mime Type	Frame Rate	H.264 Profile
High Quality	427	240	40k	600kbps	MP4	29.97fps	BASELINE
Low Quality	320	180	40k	300kbps	MP4	29.97fps	BASELINE

Table 4: PC and mobile audio

Quality	Sample Rate	Bit rate	Channels	Codec
Single Quality	22050	40k	stereo	MPEG-4 AAC

5. Streaming Sever: used for transmitting video and audio types throughout the Internet. This mobile application was designed to support Flash Media Server (FMS) which passes the RTMP protocol. The result of testing FMS compared with Wowza and Red5 found that FMS has a high performance and the interfaces were user friendly.
6. Encoder: used for converting and compressing video files and audio files to the correct format. Encoder software is used along with live streaming, but for VDO on demand streaming could be used for other software encoding as follows:
   - FMLE (Adobe Media Live Encoder) is software used along with FMS for encoding into multi bandwidths.
   - FFMPEG is open source software using a command line.
   - WireCast is software that works with FMLE and FMPEG. It adds various special effects and encodes video files. It is different from;
   - FMLE that must connect with equipment for developing photographs.

   The result of testing found that FMLE works along with FMS; therefore it was used for developing mobile TV applications.
7. Protocol: is the format of sending information via the Internet. MMS (Microsoft Media Sever) using Window Media Player for displaying video and audio files. Flash Media Sever uses RTMP for displaying video and audio. The mobile broadcast application was designed to use RTMP protocol and HTTP Live streaming to support mobile TV.
8. Player: is the software for playing multimedia files but does not support flash players (iPhone, iPod, and iPad). A solution to solve this problem was found by using HTML 5 Video with supporting Safari on iOS with version 1.0. Therefore, the protocols developing mobile TV applications were integrated with HTTP through Flash Player API + HTML 5 Video.

   A summary of tools for developing a mobile TV application are as follows:
   - OS: Windows 2008 64 bit
   - Web server: IIS7.
   - Sever scrip: ASP.NET 2+
   - Client scrip: Java script, HTML 5, CSS
   - Database: MySQL 5
   - Stream sever: FMS 4.5
   - Encoder: FMLE 3.2
   - Flash play API: Strobe media player

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MOBILE IPTV IN THE CLASSROOM

A Mobile IPTV prototype was used with 150 third-year students who enrolled in a 10 week Strategic Information Planning for Organization course in information technology program at the Faculty of Science & Technology at Suan Dusit Rajabhat University.

The experiment was run as follows: Firstly, the students were told to access the platform on their mobile device, study the content topics and watch the video about the strategic information system case study. While they were using the Mobile IPTV system their actions and navigation times where recorded for further analysis. After students developed their group project case study, they uploaded their video presentation to YouTube and linked to the Mobile IPTV system. During the learning process observations and in depth-interviews were conducted. The evaluation process aimed to gather user's feedback regarding mobile phones in learning, attitudes towards using mobile phones in learning, an evaluation of IPTV systems and an evaluation of the mobile IPTV system.

There were five parts of the survey as follows:

Part I Student demographic (7 questions, Check-list)

Part II Student's behavior using mobile phones in learning (12 questions, 5 Likert scale)

Part III Student's attitude towards using mobile phones in learning (12 questions, 5 Likert scale)

Part IV the IPTV system evaluation (15 questions, 5 Likert scale)

Part V The mobile IPTV system evaluation (15 questions, 5 Likert scale)

The survey ran the Cronbach Alpha value of 0.902 which is greater than 0.9, meaning that reliability level is excellent.

RESULTS

1. The demography of students

The result of demography of the students is shown in tables 5–11.

Table 5:Gender

	Frequency	Percent
Male	95	63.3
Female	55	36.7
Total	150	100.0

Table 5 depicting the result of gender found that 95 students (63.3 %) were male and 55 students (36.7 %) were female.

Table 6: Age

Age	Frequency	Percent
15-18	2	1.3
19-21	139	92.7
22-25	9	6.0
Total	150	100.0

Table 6 depicting the result of range of age found that 139 students (92.7 %) are aged between 19-21 year, 9 students (6%) are aged in between 22-25 years and 2 students are aged between 15-18 years.

Table 7: GPA

GPA	Frequency	Percent
2.01-2.50	43	29.9
2.51-3.00	77	53.5
3.01-3.50	18	12.5
3.51-4.00	6	4.2

Table 7 depicting the result of range of age found that 139 students (92.7%) are aged in between 19–21 years, 9 students (6%) are aged between 22–25 years and 2 students are aged between 15-18 years.

Table 8: Type of mobile phone used

Mobile Phone	Frequency	Percent
iPhone	65	43.9
Samsung	43	29.1
Nokia	14	9.5
Imobile	2	1.4
Other	24	16.2
Total	148	100.0

Table 8 depicts the result of type of mobile phone used found that mostly students used iPhone (43.9%), secondly they used Samsung (29.1%) and third other brands (16.2%).

Table 9: Internet use per day

Internet use Hours/day	Frequency	Percent
>1 hours	10	6.7
1-3 hours	22	14.7
4-5 hours	44	29.3
6-7 hours	46	30.7
< 8	28	18.7
Total	150	100.0

Table 9 depicting the result of Internet use per day found that mostly students spent 6-7 hours/day (30.7 %), second spent 4-5 hours/day (29.3%) and third more than 8 hours/day (18.7%).

Table 10: Payment of mobile phone

Payment	Frequency	Percent
Prepaid	76	50.7
Postpaid	69	46.0
Other	5	3.3
Total	150	100.0

Table 10 depicting the result of methods of mobile phone payment found that mostly students used prepaid (50.7%) and using postpaid (46.0%).

Table 11:Mobile phone package

Package	Frequency	Percent
Call only	47	31.3
Call+SMS	13	8.7
Call+SMS+Internet	90	60.0
Total	150	100.0

Table 11 depicting the results of mobile phone packages found that mostly students used Call+SMS+Internet (60%), second usedcall only (31.3%) and Call+SMS (8.7%).

2. Student's behavior using mobile phone in learning

Table 12: Student's behavior using mobile phones in learning

Student's behavior using mobile phones in learning	Mean	SD
1. Using mobile phone to take pictures during lectures	2.98	1.17
2. Using mobile phones to make notes or appointments during study	3.19	0.95
3. Using mobile phones to record lectures	3.07	0.98
4. Using mobile phones to communicate with classmates	4.03	0.93
5. Using mobile phones to communicate with lecturer	2.81	1.04
6. Using mobile phones to access the information system provided by the university	3.43	1.03
7. Using mobile phones for searching information to do homework	3.61	1.10
8. Using mobile phones to access the university Wi-Fi	3.82	0.96
9. Using Facebook via mobile phone	4.09	1.02
10. Using Twitter via mobile phone	2.38	1.35
11. Using YouTube via mobile phone	3.39	1.13
12. Using Line via mobile phone	3.97	1.40

Table 12 depicting the results of student's behavior using mobile phones in learning found that students used Facebook (Mean =4.09, SD =1.02), second used their mobile phone to communicate with class mates (Mean = 4.03, SD =0.93), and third used Line (Mean = 3.97, SD =1.40) respectively.

3. Student's attitudes towards using mobile phones in learning

Table 13: Student's attitude towards using mobile phones in learning

Student's behavior using mobile phones in learning	Mean	SD
1. Using mobile phone increased effective learning	3.75	0.89
2. Sharing information on social networks can share learning experiences	3.83	0.76
3. Using a mobile phone is more convenient for study	3.81	0.97
4. A mobile phone can share information with classmates effectively	3.99	0.90
5. Using a mobile phone for revising lecture and learning	3.59	0.89
6. A mobile phone can replace a notebook computer	3.27	1.10
7. The university should provide mobile phones rather than notebook computers	2.45	1.35
8. The university should develop applications in m-Learning system	3.67	0.98

Table 13 depicts the result of student's attitudes towards use of mobile phones in learning found that students using mobile phones can share information with classmates effectively (Mean =3.99, SD =0.90), second sharing information on social networks can share the learning experience (Mean =3.83, SD =0.76), second and third using mobile phones more convenient for study (Mean = 3.81, SD =0.97), respectively.

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4. IPTV and mobile IPTV system evaluation

Table 14: The IPTV and mobile IPTV system evaluation

The IPTV and mobile IPTV system evaluation	IPTV		Mobile IPTV	
	Mean	SD	Mean	SD
1. Easy to access the system	3.49	0.66	3.65	0.69
2. The system is easy to use	3.55	0.62	3.69	0.75
3. The system is interesting	3.64	0.77	3.79	0.69
4. The system provides useful functions	3.51	0.65	3.60	0.72
5. The system supports effective Internet use	3.59	0.67	3.59	0.71
6. The system can broadcast multimedia effectively	3.69	0.69	3.69	0.75
7. The design of the website is attractive	3.49	0.72	3.58	0.63
8. The content on the system can be applied in self-learning	3.51	0.65	3.59	0.73
9. The content on the system can be applied in daily life	3.59	0.72	3.67	0.70
10. The content on the system is interesting	3.65	0.78	3.64	0.74
11. Students can revise lectures on Video on Demand	3.49	0.74	3.65	0.72
12. The system supports self-learning	3.55	0.71	3.59	0.75
13. Knowledge gained from the system can improve learning outcomes	3.38	0.73	3.52	0.70
14. The system can be used to share information with classmates	3.63	0.68	3.64	0.76
15. Overall satisfaction	3.61	0.65	3.70	0.78

Table 14 depicting the results of the IPTV and mobile IPTV system evaluation found that overall mobile IPTV had a higher satisfaction (Mean = 3.70, SD. =0.78) than IPTV (Mean = 3.61, SD. =0.65). The result found that the highest score was mobile IPTV is interesting (Mean = 3.79, SD. =0.69), second overall mobile IPTV satisfaction (Mean = 3.70, SD. =0.78) and third mobile IPTV is easy to use (Mean = 3.69, SD. =0.75), respectively.

Here are some comments to illustrate the evaluation of IPTV and the mobile IPTV:

"We shared information about how to develop a business plan because this is new for us. We shared pictures, information, and video clips to other groups via Facebook".

"We like to watch "English More" programs on channel 3, to practice our English"

"We think every learning application should go with mobile technology because it is very convenient and easy to use, we can study everywhere and at anytime.

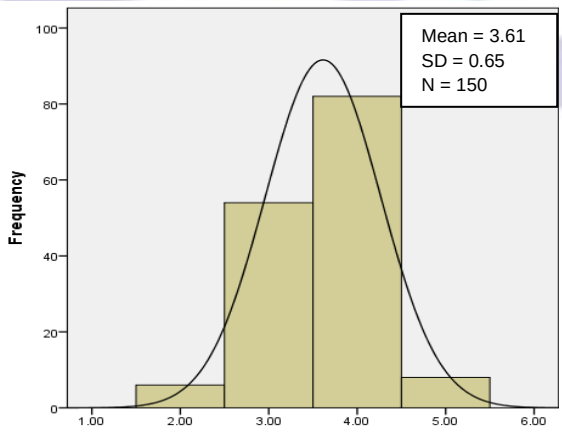

Figure 6: IPTV system overall satisfaction

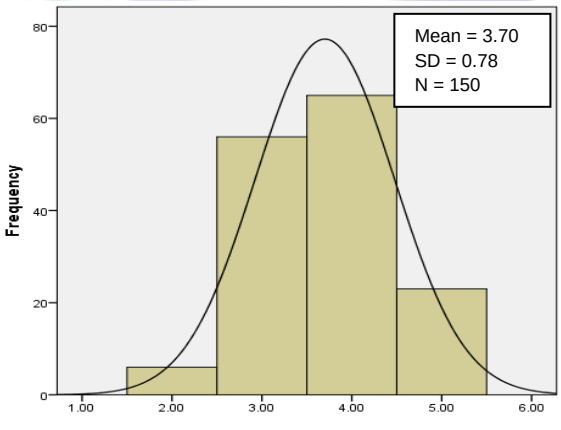

Figure 7: Mobile IPTV system overall satisfaction

Figure 7 depicting the results of the mobile IPTV system overall satisfaction (Mean = 3.70, SD. =0.78) is higher than the IPTV system overall satisfaction (Mean = 3.61, SD. =0.65).

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Table 15: Comparison of Statistics

Statistics				
	Behavior of using mobile phones in learning	Attitudes towards using mobile phone in learning	IPTV system evaluation	Mobile IPTV system evaluation
N	150	150	150	150
Mean	3.3641	3.5433	3.6133	3.7000
Median	3.4615	3.6250	4.0000	4.0000
Std. Deviation	.64004	.66048	.65320	.77503
Skewness	-.687	-.896	-.283	.053
Kurtosis	.810	.951	-.002	-.548
Minimum	1.00	1.00	2.00	2.00
Maximum	5.00	5.00	5.00	5.00

Table 15 depicts the statistical evaluation approach of the four issues. Every evaluated issue has an average between 3.3 and 3.7, leading to the conclusion of high satisfaction of high quality mobile IPTV user experience. The Skewness is negative for three variables meaning the values concentrated to the higher values of the scale. Because the user experience is a psychometric evaluation it needs to test the internal consistency (reliability) of the analyzed scale distribution. The Cronbach Alpha value is 0.902 which is greater than 0.9, meaning that reliability level is excellent.

Table 16: One-Sample Test

One-Sample Test						
	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
IPTV	67.750	149	.000	3.61333	3.5079	3.7187
Mobile IPTV	58.469	149	.000	3.70000	3.5750	3.8250

Table 16 depicts the one sample test. The result found that mobile IPTV has a higher value of mean than IPTV.

Table 17: Correlation between behavior of using mobile phones in learning and attitudes towards using mobile phones in learning with IPTV

		Behavior of using mobile phone in learning	Attitude towards of using mobile phone in learning
Kendall's tau_b	IPTV	.328**	.256**
Spearman's rho	IPTV	.396**	.313**

**Significant < 0.10

Table 17 depicts the correlation between behavior using mobile phones in learning and attitudes towards using mobile phones in learning with IPTV. The result found high significant correlation between IPTV and behavior and attitudes towards using mobile phones in learning.

Table 18: Correlation between behavior using mobile phone in learning and attitudes towards using mobile phones in learning with mobile IPTV

		Behavior of using mobile phone in learning	Attitude towards of using mobile phone in learning
Kendall's tau_b	Mobile IPTV	.343**	.328**
Spearman's rho	Mobile IPTV	.417**	.406**

**Significant < 0.10

Table 18 depicts the correlation between behavior using mobile phones in learning and attitude towards using mobile phones in learning of mobile IPTV. The result found high significant correlation between mobile IPTV and behavior and attitude towards of using mobile phone in learning.

CONCLUSION

Mobile IPTV was illustrated in this paper through the development of IPTV for education. The IPTV project background was demonstrated and explained through IPTV architecture, content, implications for education and the IPTV strategic plan for education. The mobile IPTV development had several technical issues of concern including mobile IPTV concepts, requirement details, prototyping designed, users, content, development tools, screen design, and prototype implementation in pilot project. Several tools were used to develop the mobile IPTV prototype including mobile devices, browsers, streaming servers, encoders, protocol setup and players.

The mobile IPTV prototyping was designed to support content delivery that considered the access rate, resolution and supported formats. It consisted of four channels where users could create their own content, it provided information regarding bandwidth availability, and it supported a variety of outputs, smart phone, PAD, iPad, and smart TV and various types of access networks, cable, optical, wireless, ADSL, and wireless. A mobile IPTV prototype was used with 150 third-year students enrolled in a 10 week Strategic Information Planning for Organization course in information technology program at the Faculty of Science & Technology at Suan Dusit Rajabhat University. The results found that the demography of the students, are mostly male (63.3%), aged 19–21 years (95.7%), GPA in between 2.51-3.00 (53.5%), own an iPhone (43.9%), use the Internet around 6–7 hours per day (30.7%), use mobile prepaid payment (50.7%) and employ a Call+SMS+Internet mobile package (60%).

The results of student's behavior using mobile phones in learning found that students use Facebook (Mean =4.09, SD =1.02), secondly use their mobile phone to communicate with classmates (Mean = 4.03, SD =0.93), and third use Line (Mean = 3.97, SD =1.40), respectively.

The results of student's attitudes towards using mobile phones in learning found that students using mobile phones can share information with classmates effectively (Mean =3.99 , SD =0.90), second sharing information on social networks can share learning experiences (Mean =3.83 , SD =0.76), second and third using a mobile phone is more convenient for study (Mean = 3.81 , SD =0.97), respectively. The result of the IPTV and mobile IPTV system evaluation found that overall the mobile IPTV was highest satisfaction (Mean = 3.70, SD =0.78) than IPTV (Mean = 3.61, SD =0.65).

Future work will focus on expanding more sophisticated Mobile IPTV architecture and technical requirements to take into account the wireless environment, and to focus on its implications for teaching and learning. It needs a streaming sever for mobile broadcasting content. Also, it needs to compete with the mobile IPTV standardization in the market such as DVB-CBMS, OMA-BCAST, 3GPP-MBMS, WiMax-MBS, etc. Moreover, it also needs to convert IPTV content (more than 780 programs) to mobile IPTV content.

This mobile IPTV prototype will be used for experimenting in other subjects. When the experiment finishes, this system will be evaluated using several factors such as studying users' satisfaction, attitude and learning outcomes and developing the Mobile IPTV educational framework. The mobile IPTV application can expand to 'm-Learning' or 'mobile Learning' by connecting with social networks to build communication among students and teachers. Mobile IPTV will become part of life, and expand its value to increase the quality of education in the future.

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