Weather Preference and Perceived Weather Effects among Chinese Adolescents

MYL *Chiu*, HT *Wong*, X *Yang*

Abstract

Purpose: To assess subjective weather preferences among adolescents and the perceived effects of different weather conditions on mood. ***Methods:*** A cross sectional questionnaire survey on 3,580 adolescents in Hong Kong. ***Findings:*** The periods from early autumn to mid-winter were the most popular seasons among the adolescents. A significantly higher proportion of male and younger adolescents preferred poor/unstable weather conditions, whereas a significantly higher proportion of female and adolescents with older age disliked such weather. Exploratory factor analysis has identified three major areas of impact: 1) work, study and activity; 2) mood; and 3) interpersonal relationships. More respondents believed that the first two areas were adversely affected by the weather than the third area. Moreover, "negative" and "conventional" respondents tended to report more adverse impacts than "positive" and "adventurous" respondents. Gender and age effects were also found on both weather preference and perceived effects on mood. It is plausible that adolescents had engendered views on weather preference and perceived impact, but female respondents did not report a significantly more emotional impact. ***Conclusions:*** The results could contribute to a more focused study in the future and may provide some insight on program design that promotes emotional wellness among adolescents.

Key words Adolescent; Emotions; Hong Kong; Weather

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Introduction

People generally believe that our mood is significantly related to weather conditions. Typically, a pervasive belief exists amongst the population that people feel happier on days with sunshine, which are generally called "nice days", whereas they experience bad moods with cold, dark, and cloudy weather conditions that are usually classified as "poor weather days". However, according to a review by Watson,[1] the research in this area shows little empirical evidence of the relationship between weather and mood. Moreover, only inconclusive and very weak observations were obtained from the very few studies, and the sample sizes were generally small.[2-7] Having a conclusive result in whichever direction, affirming or disaffirming, is important because research has already shown that weather has pronounced effects on human behaviour and health.

For example, suicide was found to be related to weather conditions; Page et al[8] demonstrated that a 1 degree Celsius rise in mean temperature was associated with a 3.8% and 5% increase in suicide and violent suicide respectively when the temperature was above 18 degrees Celsius. Furthermore, violent behaviour was found to be reliably related to higher temperatures.[9,10] A possible interpretation for the findings is that a higher temperature and sunlight increase risk tolerance and negative mood, which in turn increases the likelihood for suicidal behaviour and aggression. In light of the research, the effects of weather conditions on mood could be a mediator between behaviour (e.g. suicide or aggression) and weather, especially for adolescents who are generally less prepared for handling their emotions.

Referring back to the studies focusing on mood instead of behaviour, some studies reported a significant and explicit relationship between weather and mood. For example, it was found that positive mood was proportional and inversely proportional to the level of sunshine and relative humidity, respectively.[2,3,5-7] A high barometric pressure[3] and a high temperature[2,4] were reportedly related to positive mood. In addition, Persinger[11] reported a two-day lag between a measure of happiness and weather indices including mean daily temperature, barometric pressure, relative humidity, and number of sunshine hours. Mood scores were found to be negatively correlated with relative humidity and positively correlated to increased hours of sunshine.

In contrast, some research found an inverse relationship between temperature and mood, or potency. Namely, negative mood was associated with high temperature[3] and low potency (low potency is similar to low mood).[4] Watson[1] collected daily mood reports from undergraduate students, his results suggested no significant relationship between mood (measured by self-report using the Positive and Negative Affect Scale, PANAS) and any of the assessed weather variables (sunshine, barometric pressure, temperature, or precipitation). Another study by Clark and Watson[12] also failed to find correlations between mood and any weather parameter. These null findings were noteworthy because they called into question the commonly held belief that weather affects mood.

Although some researchers[1,12] pointed out that research on the relationship between weather and mood was insufficient and inconclusive, some insights could still be obtained from the previous works. As Sanders and Brizzolara[6] mentioned, previous research on the relationship between weather and mood have unfortunately been hampered by methodological limitations. The sample sizes of the studies were small, and only a simple bivariate analysis was conducted. Thus, the relationship among the variables observed seems very weak. However, a more precise research design or simply increasing the sample size could result in more conclusive results.

Undeterred by the vague results, researchers have continued to investigate the relationship between weather and mood; thus, three reports were identified with a large sample size. Keller et al[13] conducted three small studies to examine the effects of temperature and barometric pressure on single-occasion explicit and implicit mood valence (positive mood subtracted by negative mood) and cognition (memory and cognitive style), with 605 respondents aged from 13 to 68 years. The results showed that the relationship between weather and mood depended on the season. Due to the increased amount of time spent outside in spring, pleasant weather was related to elated mood, better memory, and "broadened" cognitive style, whereas hotter weather was associated with a lower mood in summer. In Denissen's study,[14] 1,233 participants aged from 13 to 68 years were recruited to investigate the effects of six weather parameters, including temperature, wind power, sunlight, precipitation, air pressure, and photoperiod on mood (i.e. positive affect, negative affect, and tiredness). Temperature and wind power were found to be positively and negatively associated with negative affects respectively. Sunlight was found to be negatively associated with negative affects and tiredness. Huibers et al[15] investigated the relationship between weather and mood with around 15,000 participants. However, only seasonal variations were found on the prevalence of major depression and sad moods. Relationships between mood and weather factors such as temperature, hours of sunshine, and amount of rain were not found in their study. Lately, Tsutsui[16] found that subjective happiness had a quadratic relationship with temperature. Particularly, happiness was maximised at 13.9 degrees Celsius. Moreover, temperature effects on happiness also depended on the subjects' demographic characteristics such as gender, age, and academic departments. However, the effects of humidity, wind speed, precipitation, and sunshine were insignificant.

This research aimed at assessing respondents' subjective weather preferences and the effects of different weather conditions on mood among a group of adolescents. For the purposes of this article, the term "mood" here refers to the phenomenological property of an individual's subjectively perceived affective or feeling state; e.g., someone may be in a cheerful mood or a hostile mood. Such states are particularised to specific times and situations[17] and may be contrasted with those that are relatively stable and permanent.[18] Typically, moods can be categorised into two

different types including positive moods such as cheeriness, peacefulness, and sexual warmth and negative moods such as anxiety, guilt, and depression. Having a clear picture of the subjective preferences and effects is helpful in providing foundational knowledge on which a more focused research design could be planned for future analysis on the objective relationship between weather and mood and some common beliefs about the relationship. Moreover, as mentioned previously, as adolescents are generally more willing to express their emotions and they are less well-prepared to handle their emotions than adults, the study would provide a deep insight for adolescents' emotional regulation and potential factors that affect their daily emotions.

Methods

In this research, 3,580 secondary school students were recruited in the study from October to November 2010 in Hong Kong through a citywide on-campus school-based psychological health promotion programme, which aimed to raise the awareness, expression, and handling of emotions among adolescents. The study was commissioned by Joyful Mental Health Foundation, Hong Kong[19] and ethical approval was obtained from the Research Committee of the concerned university. Survey questionnaires were distributed at the workshop meetings held at 15 secondary schools, which was part of the health promotion programme. The workshop recruitment was on a voluntary basis and welcome students of all forms to join. The participant size of each workshop ranged from 20 to 100, depending on how keen the school promoted it to their students. Altogether about 4,500 students attended these workshop and 3,580 returned the filled questionnaire. No randomisation design was planned because of avoiding extra administration work for the school personnel who are involved, and partly because it was estimated that the convenient sample is big enough to provide inference. The adolescents completed the anonymous self-administered semi-structured questionnaire, which was collected immediately afterwards. The content of the questionnaire related to four areas including: 1) basic demographic information; 2) their preferences for different weather conditions (like, dislike or neutral) and seasons (like or dislike); 3) their perceptions on the degree of effects of different weather conditions on their mood (from -3: very negative effect to 3: very positive effect); and 4) their perceptions on the effects of "unfavourable" weather conditions on different aspects related to mood, social relationship, work, study and activity

(from 1: strongly agree to 4: strongly disagree).

Descriptive statistics were used to illustrate the demographic background of the respondents. The respondents' favourite seasons were compared by gender and age using Chi-Square test and independent sample t-test. Respondents' preference for weather conditions and perceived degree of effects of weather conditions on mood were compared using Chi-Square test and Pearson correlation, respectively, based on gender and age.

Finally, the responses to the 30 statements regarding respondents' perceptions on the effects of adverse weather conditions on different aspects related to their daily life were combined into two groups (i.e. strongly agree/agree and strongly disagree/disagree) and compared with a Chi-Square test based on gender. The correlation between the original uncombined responses and age were also analysed using Pearson correlation. Then, exploratory factor analysis[20] was used to classify the 30 statements into subgroups, and the sub-score of each subgroup was obtained by summing the raw responses to the statements. At the same time, respondents were also grouped into pairs (positive vs. negative and adventurous vs. conventional). The definitions of the grouping were: 1) "positive respondents" were participants who like "fine" and "cloudy, turning to fine"; 2) "negative respondents" were participants who dislike "fine" and "cloudy, turning to fine"; 3) "adventurous respondents" were participants who like "heavy rain", "thunderstorms", "fine, turning to cloudy or rain", "suddenly change to cold" and "suddenly change to hot"; and 4) "conventional respondents" were participants who dislike "heavy rain", "thunderstorms", "fine, turning to cloudy or rain", "suddenly change to cold" and "suddenly change to hot". The sub-scores of the four groups of respondents were compared using an independent t-test.

Due to the large sample size, the level of significance was set at p<0.01 except for the comparison of predefined student groups (i.e. the results in Table 1), the level of significance was set at p<0.05. Statistical analysis was carried out using the statistical package of SPSS 16.0.

Results

Demographic Characteristics

Table 2 shows the demographic background of the respondents. Their mean age was 14.5 ranging from 11 to 21 years old. More than half of them were female (62.5%). Half of them (52.2%) were studying in the lower Forms

Table 1 Comparison of the perceived effects of unfavourite weather conditions by predefined respondent type

Factor	Respondent type	N	Average score[+]	Standard Error	Average difference	p-value
Mood	Positive	1539	2.85	0.70	0.21	0.00**
	Negative	144	2.64	0.86		
Relationship	Positive	1541	2.99	0.55	0.20	0.00**
	Negative	146	2.79	0.72		
Work, study and activity	Positive	1541	2.37	0.68	0.14	0.03*
	Negative	145	2.23	0.78		
Mood	Adventurous	53	3.14	0.92	0.35	0.01**
	Conventional	314	2.78	0.76		
Relationship	Adventurous	53	3.09	0.92	0.20	0.14
	Conventional	315	2.89	0.61		
Work, study and activity	Adventurous	53	2.99	0.99	0.70	0.00***
	Conventional	314	2.29	0.65		

*$p<0.05$; **$p<0.01$; ***$p<0.001$; [+]1: strongly agree; 2: agree; 3: disagree; and 4: strongly disagree

Table 2 Demographic characteristics

Demographic factors	Mean (SD)	Range
Age	14.5 (1.9)	11-21
	Number	Percentage
Gender		
Male	1333	37.5
Female	2219	62.5
Year of study[+]		
Form 1	642	18.0
Form 2	700	19.6
Form 3	520	14.6
Form 4	766	21.5
Form 5	518	14.5
Form 6	214	6.0
Form 7	203	5.7

[+]Form 1 to 7 is equivalent to year 7 to 13 in US education system

(Form 1-3), whereas only around 12% were studying in Forms 6 and 7 (Form 1 to 7 is equivalent to year 7 to 13 in US education system).

Favourite Seasons

Table 3 shows that the period from early autumn to mid-winter tended to be the most popular season with a proportion of respondents ranging from 38.9% to 56.6%. When the data was stratified by gender, although significant differences were observed for mid-spring, early summer, mid-summer, and early winter ($p<0.01$), no systematic pattern was observed. When analysing the age effects, respondents replied that Autumn was their favourite season were significantly older ($p<0.001$), whereas those replied early spring, mid spring, and mid-summer were significantly younger ($p<0.01$). However, the corresponding mean age differences were less than half year, which was considered as clinically insignificant.

Weather Preferences and Perceived Effects of Weather Conditions on Mood

Table 4 shows respondents' preferences and their perceived effects of weather conditions on mood by gender. Generally, respondents preferred good/stable weather (i.e. fine and cloudy) rather than other poor/unstable weather, except for typhoons and cold weather. In fact, more respondents expressed a liking for typhoons and cold days than a disliking. When the dataset was stratified by gender, the pattern showed that a consistently higher proportion of male respondents liked poor/unstable weather conditions including heavy rain, dry, humid, thunderstorms, typhoon, hot and cold ($p<0.01$). Moreover, male respondents perceived that these poor/unstable weather conditions had significantly lower negative or higher positive effects on their mood ($p<0.01$) except for cold weather, for which no statistical difference was observed ($p=0.18$). Similarly, a consistently higher proportion of females disliked the poor/unstable weather conditions except for cold weather ($p<0.001$).

Table 5 shows the Pearson correlations of respondents' age with their preference of different weather conditions and the corresponding perceived effects on mood. Results showed that the older respondents were significantly less

Table 3 Participants' favourite seasons by gender and age

Season	Gender[+]			Overall	Age[++]		
	Male	Female	p-value		No indication	Like	p-value
Early-spring	472 (35.6)	711 (32.2)	0.04*	1187 (33.4)	14.5 (1.9)	14.3 (1.8)	0.01**
Mid-spring	375 (28.2)	515 (23.3)	0.00**	890 (25.0)	14.5 (1.9)	14.3 (1.8)	0.00**
Late-spring	252 (19.0)	400 (18.1)	0.51	654 (18.4)	14.5 (1.9)	14.4 (1.9)	0.26
Early-summer	352 (26.5)	684 (30.9)	0.01**	1039 (29.2)	14.5 (1.9)	14.4 (1.9)	0.46
Mid-summer	326 (24.5)	425 (19.2)	0.00***	753 (21.1)	14.5 (1.9)	14.1 (1.8)	0.00***
Late-summer	350 (26.3)	628 (28.4)	0.19	986 (27.7)	14.5 (1.9)	14.3 (1.9)	0.02*
Early-autumn	640 (48.2)	1154 (52.2)	0.02*	1809 (50.8)	14.3 (1.8)	14.6 (1.9)	0.00***
Mid-autumn	730 (54.9)	1275 (57.6)	0.12	2019 (56.6)	14.3 (1.9)	14.6 (1.9)	0.00***
Late-autumn	542 (40.8)	928 (41.9)	0.50	1478 (41.5)	14.3 (1.9)	14.6 (1.9)	0.00***
Early-winter	597 (44.9)	1134 (51.3)	0.00***	1739 (48.8)	14.4 (1.9)	14.5 (1.9)	0.06
Mid-winter	510 (38.4)	871 (39.4)	0.56	1385 (38.9)	14.5 (1.9)	14.4 (1.8)	0.02*
Late-winter	447 (33.7)	764 (34.6)	0.60	1218 (34.2)	14.5 (1.9)	14.4 (1.8)	0.04*

*p<0.05; **p<0.01; ***p<0.001; [+]the values below are the number of respondents and percentage; [++]the values below are the mean age and standard deviation

Table 4 Participants' preferences and their perceived effects of different weather conditions on mood by gender

Weather condition	Gender	Preference				Perceived effects on mood[+]		
		Like	Dislike	Neutral	p-value	Marks	Mean difference	p-value
Fine	Male	859 (64.9)	114 (8.6)	351 (26.5)	0.00***	1.12 (1.56)	-0.172	0.01**
	Female	1460 (66.1)	107 (4.8)	642 (29.1)		1.30 (1.31)		
	Total	2319 (65.6)	221 (6.3)	993 (28.1)		1.23 (1.41)		
Cloudy	Male	680 (51.7)	256 (19.5)	380 (28.9)	0.00***	0.53 (1.57)	0.107	0.04*
	Female	1044 (47.3)	382 (17.3)	779 (35.3)		0.42 (1.38)		
	Total	1724 (49.0)	638 (18.1)	1159 (32.9)		0.46 (1.45)		
Light rain	Male	519 (39.5)	387 (29.5)	407 (31.0)	0.60	0.19 (1.46)	-0.025	0.62
	Female	871 (39.5)	621 (28.1)	715 (32.4)		0.21 (1.35)		
	Total	1390 (39.5)	1008 (28.6)	1122 (31.9)		0.20 (1.39)		
Heavy rain	Male	374 (28.4)	716 (54.3)	228 (17.3)	0.00***	-0.41 (1.92)	0.366	0.00***
	Female	451 (20.5)	1270 (57.6)	483 (21.9)		-0.78 (1.74)		
	Total	825 (23.4)	1986 (56.4)	711 (20.2)		-0.64 (1.82)		
Dry	Male	222 (16.9)	762 (57.9)	333 (25.3)	0.00***	-0.60 (1.57)	0.134	0.01*
	Female	237 (10.7)	1330 (60.3)	639 (29.0)		-0.74 (1.36)		
	Total	459 (13.0)	2092 (59.4)	972 (27.6)		-0.69 (1.44)		
Humid	Male	128 (9.7)	936 (70.7)	260 (19.6)	0.00***	-1.03 (1.51)	0.348	0.00***
	Female	62 (2.8)	1737 (78.8)	406 (18.4)		-1.38 (1.29)		
	Total	190 (5.4)	2673 (75.7)	666 (18.9)		-1.25 (1.38)		
Thunder-storms	Male	422 (32.0)	571 (43.3)	325 (24.7)	0.00***	-0.08 (1.74)	0.353	0.00***
	Female	517 (23.4)	1067 (48.4)	621 (28.2)		-0.44 (1.64)		
	Total	939 (26.7)	1638 (46.5)	946 (26.9)		-0.30 (1.69)		
Typhoon	Male	701 (53.0)	289 (21.8)	333 (25.2)	0.00***	0.70 (1.88)	0.363	0.00***
	Female	937 (42.4)	599 (27.1)	672 (30.4)		0.34 (1.79)		
	Total	1638 (46.4)	888 (25.1)	1005 (28.5)		0.48 (1.83)		
Hot	Male	97 (7.3)	954 (72.1)	272 (20.6)	0.00***	-1.12 (1.65)	0.427	0.00***
	Female	69 (3.1)	1778 (80.6)	359 (16.3)		-1.55 (1.38)		
	Total	166 (4.7)	2732 (77.4)	631 (17.9)		-1.39 (1.50)		
Cold	Male	471 (35.7)	416 (31.5)	432 (32.8)	0.00**	0.17 (1.78)	0.081	0.18
	Female	726 (32.9)	617 (28.0)	864 (39.1)		0.09 (1.63)		
	Total	1197 (33.9)	1033 (29.3)	1296 (36.8)		0.12 (1.69)		

*p<0.05; **p<0.01; ***p<0.001; [+]3 very negative; 3: very positive

prefer the weather of light rain, humid, and hot days (p<0.001), and the corresponding perceived weather effects on their mood were also significantly more negative (p<0.01). In contrast, the older respondents were significantly more prefer fine (p<0.01) and dry weather (p<0.001), while only the perceived effects of dry weather on their mood were significant more positive (p<0.01).

Perceived Effects of Unfavourable Weather Conditions

Table 6 shows the result of exploratory factor analysis of the 30 statements regarding respondents' perceived effects of unfavourable weather conditions. Most of the statements had a high factor loading exceeding 0.5 and all of the statements exceeded 0.4, except for statement 17, "unfavourable weather conditions affected your willingness to go to school". As the highest factor loading of this statement among the three areas of impact was only 0.30, this statement could not be considered further. The remaining 29 statements were classified into three factors: 1) statements 1-11, 15, and 21-22 belong to the factor "relationship"; 2) statements 12-14, 16, 18-20, and 28 belong to the factor "work, study, and activity"; and 3) statements 23-27 and 29-30 belong to the factor "mood".

Table 7 showed the results of the remaining statements (item 17 dropped) regarding respondents' perceived effects of unfavourable weather conditions. For all the respondents, the five most affected aspects were: 1) statement 12 "do

Table 5 Correlation analysis of participants' age with their weather preferences and perceived effects of weather on mood

Weather condition	Preference[+]		Perceived effects on mood[++]	
	ρ	p-value	ρ	p-value
Fine	0.05	0.01**	-0.01	0.70
Cloudy	0.00	0.98	-0.03	0.07
Light rain	-0.08	0.00***	-0.08	0.00***
Heavy rain	-0.04	0.02*	-0.04	0.01*
Dry	0.07	0.00***	0.06	0.00**
Humid	-0.11	0.00***	-0.10	0.00***
Thunder-storms	-0.01	0.45	-0.02	0.34
Typhoon	-0.02	0.18	-0.03	0.06
Hot	-0.07	0.00***	-0.05	0.00**
Cold	-0.04	0.02*	-0.04	0.01*

*p<0.05; **p<0.01; ***p<0.001; [+]-1: dislike; 0: neutral; 1: like; [++]-3 very negative; 3: very positive

Table 6 Factor loading of the 3 factors for the 30 questions

No. Question	Factors		
	1	2	3
1 Want to be alone	0.029	0.560	0.441
2 Feel lonely	0.167	0.571	0.326
3 Do not want to have contact with others	0.113	0.696	0.414
4 Difficult to get along with others	0.271	0.728	0.210
5 Feel uncomfortable when getting along with others	0.285	0.642	0.301
6 Not easy to trust others	0.326	0.744	-0.032
7 Look tense	0.416	0.520	0.130
8 Do not want to communicate with others	0.303	0.682	0.315
9 Afraid to get along with others	0.351	0.747	0.000
10 Distrust of others	0.379	0.732	-0.043
11 To argue with others easily	0.492	0.436	0.311
12 Do not want to go out	0.038	0.113	0.745
13 Do not want to work or study	0.244	0.143	0.764
14 Lose patience	0.447	0.175	0.621
15 Feel get along with others become disharmonious	0.538	0.507	0.267
16 Lose intention to study	0.365	0.154	0.690
17 Not go to school	0.206	0.299	0.233
18 Do not want to go to school	0.150	0.094	0.710
19 Affect your academic performance	0.520	0.177	0.512
20 Lack of motivation, do not want having outdoor activities	0.206	0.110	0.733
21 Affect my relationships with family or friends	0.605	0.497	0.073
22 Reluctant to talk with family or friends	0.572	0.504	0.180
23 Affect my thinking, make me made a wrong decision	0.722	0.339	0.164
24 Affect my thinking, more difficult to make decision	0.711	0.302	0.236
25 Become anxious	0.661	0.197	0.376
26 Thinking negative	0.635	0.320	0.354
27 To lose temper easily	0.655	0.204	0.423
28 Lose momentum when doing things	0.525	0.186	0.546
29 Mentally tormented	0.682	0.344	0.266
30 Emotion become negative	0.661	0.311	0.356

Extraction Method: Principal Component Analysis.
Rotation Method: Equamax with Kaiser Normalisation.
Mood: Question 23-27 and 29-30 (Mean score: 2.81; SD= 0.72)
Relationship: Question 1-11, 15 and 21-22 (Mean score: 2.94; SD = 0.59)
Work, study, and activity: 12-14, 16, 18-20 and 28 (Mean score: 2.34: SD=0.69)

Table 7 Participants' perceived effects of unfavourite weather conditions by age and gender

No. Question	Gender[+]			Total	Age[++]	
	Male	Female	p-value		ρ	p-value
1 Want to be alone	542 (41.0)	974 (44.1)	0.07	1524 (42.9)	-0.12	0.00***
2 Feel lonely	425 (32.1)	694 (31.4)	0.63	1127 (31.7)	-0.09	0.00***
3 Do not want to have contact with others	428 (32.4)	729 (33.0)	0.73	1165 (32.8)	-0.13	0.00***
4 Difficult to get along with others	350 (26.6)	446 (20.2)	0.01***	799 (22.5)	-0.10	0.00***
5 Feel uncomfortable when getting along with others	434 (32.9)	653 (29.6)	0.04*	1090 (30.7)	-0.09	0.00***
6 Not easy to trust others	267 (20.2)	190 (8.6)	0.01***	458 (12.9)	-0.06	0.00**
7 Look tense	374 (28.5)	472 (21.4)	0.01***	850 (24.0)	-0.01	0.74
8 Do not want to communicate with others	416 (31.6)	637 (28.8)	0.08	1057 (29.8)	-0.09	0.00***
9 Afraid to get along with others	262 (19.8)	211 (9.6)	0.01***	474 (13.4)	-0.09	0.00***
10 Distrust of others	259 (19.6)	166 (7.5)	0.01***	426 (12.0)	-0.06	0.00**
11 To argue with others easily	430 (32.6)	790 (35.8)	0.05*	1225 (34.5)	-0.05	0.00**
12 Do not want to go out	850 (64.6)	1734 (78.6)	0.01***	2599 (73.4)	-0.05	0.01**
13 Do not want to work or study	762 (57.8)	1451 (65.7)	0.01***	2223 (62.7)	-0.05	0.00**
14 Lose patience	656 (49.8)	1239 (56.2)	0.01***	1902 (53.7)	-0.02	0.19
15 Feel get along with others become disharmonious	354 (26.9)	486 (22.1)	0.00**	842 (23.8)	-0.08	0.00***
16 Lose intention to study	658 (49.9)	1244 (56.4)	0.01***	1909 (53.9)	-0.07	0.00***
17 Not go to school	–	–	–	–	–	–
18 Do not want to go to school	808 (61.1)	1534 (69.5)	0.01***	2352 (66.3)	-0.05	0.01**
19 Affect your academic performance	601 (45.6)	895 (40.8)	0.01**	1505 (42.6)	-0.06	0.01**
20 Lack of motivation, do not want having outdoor activities	779 (59.2)	1596 (72.6)	0.01***	2385 (67.5)	-0.08	0.00***
21 Affect my relationships with family or friends	312 (23.8)	312 (14.2)	0.01***	624 (17.7)	-0.07	0.00***
22 Reluctant to talk with family or friends	321 (24.4)	439 (19.9)	0.00**	764 (21.6)	-0.08	0.00***
23 Affect my thinking, make me made a wrong decision	371 (28.1)	408 (18.5)	0.01***	781 (22.0)	-0.05	0.01**
24 Affect my thinking, more difficult to make decision	430 (32.6)	585 (26.6)	0.01***	1019 (28.8)	-0.02	0.23
25 Become anxious	508 (38.6)	941 (42.7)	0.02*	1453 (41.1)	0.00	0.99
26 Thinking negative	469 (35.5)	760 (34.5)	0.52	1232 (34.8)	-0.07	0.00***
27 To lose temper easily	507 (38.4)	1002 (45.5)	0.01***	1515 (42.7)	-0.02	0.21
28 Lose momentum when doing things	574 (43.5)	1044 (47.4)	0.02*	1624 (45.8)	-0.06	0.00***
29 Mentally tormented	405 (30.6)	527 (23.9)	0.01***	936 (26.4)	-0.06	0.01**
30 Emotion become negative	457 (34.6)	737 (33.4)	0.48	1199 (33.8)	-0.08	0.00***

*p<0.05; **p<0.01; ***p<0.001; [+]The values below are the number and percentage of respondents answered agree/strongly agree; [++]1: strongly agree; 2: agree; 3: disagree; and 4: strongly disagree

Note: Item 7 is dropped because of the low factor loadings (please refer to Table 6 for details).

not want to go out" (73.4%); 2) statement 20 "lack of motivation, do not want to have outdoor activities" (67.5%); 3) statement 18 "do not want to go to school" (66.3%); 4) statement 13 "do not want to work or study" (62.7%); and 5) statement 16 "lose intention to study" (53.9%). All five most affected aspects related to the factor of work, study, and activity. The five least affected aspects were 1) statement 10 "distrust of others" (12%); 2) statement 6 "not easy to trust others" (12.9%); 3) statement 9 "afraid to get along with others" (13.4%); 4) statement 21 "affected my relationships with family or friends" (17.7%); and 5) statement 22 "reluctant to talk with family or friends" (21.6%). All of the least affect aspects related to the relationship factor.

When the data was stratified by gender, the statements related to relationship (item 1-11, 15 and 21-22) and mood (item 23-27 and 29-30) with significant gender difference had a higher proportion of male respondents agreed with the statements (p<0.01) except for statement 27 "to lose temper easily", with which a significantly higher proportion of female respondents agreed (p<0.001). For the statements related to work, study and activity with significant gender difference, higher proportion of female respondents agreed with the statements (p<0.001) with the exception of statement 19 "affect your academic performance", with which a significantly higher proportion of male respondents agreed (p<0.01).

For the correlation analysis with age, 24 of the 29 statements obtained significant result, which was more than the observed gender differences (19 statements). Older the respondents, more of them agreed the unfavourite weather conditions have the corresponding negative effects on them, which the 24 statements of negative effects remarkably belonged to all three factors (i.e. "interpersonal relationship", "mood", and "work, study and activity") (p<0.01).

Table 1 shows the result of a comparison of perceived effects of unfavourable weather conditions by predefined type of respondents. Comparison between "positive" and "negative" respondents, which were defined in the method section, revealed that "negative" respondents tended to express stronger agreement to being affected by unfavourable weather conditions in all three factors with mean sub-score differences ranging from 0.14 to 0.21 (p<0.05). The comparison between adventurous and conventional respondents showed even greater differences in the aspects of "mood" and "work, study and activity". The corresponding mean sub-score differences were 0.35 (p<0.01) and 0.70 (p<0.001), respectively.

Discussion

This research demonstrates the most popular seasons among adolescents in a sub-tropical climate. The popularity of the period from early autumn to mid-winter suggested that cooler weather was more favourable to respondents. This could be related to the excitement of starting a new academic year that there is a chance of meeting their classmates. On the other hand, as normally students are required to take mid-term exam at the end of a year, this could be an explanation of why the respondents were less favourite the seasons after mid-winter. Regarding weather conditions, a higher proportion of male respondents preferred poor/unstable weather conditions whereas a higher proportion of female respondents disliked such conditions. The same pattern also appeared among younger participants, though the differences were not as pronounced as the gender differences. The preference for poor/unstable weather conditions might be due to the adventurous characteristics or novelty-seeking traits of males and younger ages. The same pattern of differences in gender and age was also observed in their perceived effects on mood. Older respondents perceive poor/unstable weather conditions to have more negative effects on their mood.

Regarding the perceived effects under unfavourable weather conditions, the five most and least commonly affected aspects belong respectively to factors of "work, study, and activity" and "interpersonal relationships", suggesting that physical activity of adolescents is more easily affected. Interestingly, the impact on mood is not in the above list, and it appears that even though mood might be affected to a certain degree, they consider themselves capable of handling the impact, without adversely affecting their interpersonal relationships. Alternatively, the interpretation could stem from the belief and judgment that climate change is transient but interpersonal relationships are more enduring and consistent.

In respect of gender differences in the preference of extreme weathers and the perception of its positive and negative influences, there is little empirical evidence for such differences. It is plausible that adolescents are socialised into engendered beliefs about weather (e.g., it would not be safe for girls to go out in bad weather). It is equally plausible that male respondents are more adventurous by the nature of their species; extreme weather alone would not hinder boys' motivation to explore. However, this conclusion is highly speculative and needs supporting by future research.

The accepted belief that female subjects are more emotional is challenged by the findings of this study, or at least, significantly fewer female respondents admitted that their emotions would easily be affected by extreme weather. In fact, significantly more male than female respondents perceived that their "interpersonal relationships" and "mood" would be adversely affected. Gendered social expectations, such as boys should be less emotional than girls, may hamper their motivation to seek help for emotional problems. Social workers need to pay more attention to the gender differences in mood and interpersonal concerns.

Finally, the findings confirmed that adolescents had different perceptions of different weather. Respondents who favoured "positive" weather conditions considered themselves less adversely affected. Respondents who favoured "adventurous" weather reported greater impact than those who favoured "conventional" weather. There is a clear linkage between personal characteristics and perceived weather impact. Perceived impact on emotion is always subjective, determined by the objective weather conditions and individual characteristics and perceptions.

Limitations

Although this study has provided the analysis of a sizeable volume of survey data, the data is cross-sectional in nature and gives little clues to the actual changes over time. Secondly it is the perceived impact on mood by weather rather than the use of the mood condition. These self-reports have not been verified by on clinical scales or assessment, and therefore are of exploratory nature. The convenient sample consists of a wide coverage of students from Year 1 to Year 7 of the participating schools. A matched control design of those with and without mood disturbance may provide more useful result on the perceptual differences of the impact and the sense of self-agency. Better research design is needed supplement the limitations of this study".

Conclusion

The present study contributes to understanding the relationship between the weather and individuals' moods by exploring respondents' subjective weather preferences and the effects of various weather conditions on mood among a group of adolescents. It is interesting to find for the first time the differences of weather preferences and perceived impact on mood in gender and age of adolescents. One

practical concern and implication of this study is the finding that the impact of weather on mood may subsequently affect adolescents' classroom performance and daily behaviour.[4,21,22] For example, previous studies have demonstrated that humidity level could influence individuals' attention (concentration) and alertness (sleepiness). Given that adolescents' behaviours (e.g. aggression) have been found to be affected by negative moods,[2,10] it is worth assessing whether mood plays the role of partial or full mediator between weather and behaviour in future work. In addition, as exploratory factor analysis revealed two more factors of weather impact in addition to mood (i.e. work/study, and interpersonal relations), further study is needed to ascertain the extent and intensity of these effects. This study is particularly relevant to adolescents in sub-tropical areas where weather change could be sudden and drastic, and where people pay more attention to weather changes than the impact of such weather conditions on emotions and the daily lives of adolescents. The knowledge gained from this study could serve as a guide for future studies on weather conditions, mood, and interpersonal relationships, and for the promotion of well-being and health among adolescents. For example, mobile phone applications targeting adolescents could be developed and linked with the Hong Kong Observatory's weather forecast report. Some words of encouragement could pop up to support the person and link to self-assessment and to prompt help-seeking and contact with one's confidants.

Declaration of Interest

We declare that we have no conflict of interests.

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