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Influence of Wine Education on Wine Hedonic and Confidence Ratings by Millennial Wine Consumers of Different Ethnicities

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Abstract: Consumer wine preferences are not well understood. Anecdotally it is believed that preferences evolve over time, from sweet whites to full-bodied reds, as consumers become more experienced and familiar with wine. However, little is known about the change in wine preference or confidence with education and training. This research explored changes in consumers' hedonic and confidence ratings for five commercial British Columbian (BC) wines (Ehrenfelser, Chardonnay, rosé, Pinot noir, Cabernet-Merlot) over a 12-week education/training period. Consumers (n = 133) completed a wine survey and evaluated the wines during the first and twelfth week of a university wine course, consisting of wine education and sensory training. Consumers provided hedonic (degree-of-liking) and confidence (degree-of-sureness) ratings for the visual, aroma and flavor characteristics of the wines, on 9-point and 5-point scales, respectively, before and after the 12-week wine course. Consumers were classified by gender (female, male), age and ethnicity. Kruskal Wallis, Mann-Whitney, Friedman, Wilcoxon Signed Rank and Chi-square tests and Spearman correlation coefficients were used to explore the effects of education/training on hedonic and confidence ratings. In general, consumers' hedonic (visual, aroma, flavor) ratings increased significantly with education/training for the white and rosé wines (Ehrenfelser, Chardonnay, rosé) over the 12-week period. In contrast, consumer confidence increased substantially for all wine types. Surveys revealed, for the three largest subgroups of consumers (North American (NA), n = 38; European (EU), n = 31; Asian, n = 54), that NA and EU consumers had significantly higher frequency-of-purchase, frequency-of-purchase of Canadian wine, frequency-of-consumption and self-rated wine knowledge than Asian consumers. However, Asian consumers were willing to pay more for a bottle of wine compared to NA and EU consumers. This research provided insight into the millennial consumers and explored the nature and magnitude of changes in hedonic and confidence ratings with wine education/training.

Keywords: wine education; wine hedonic rating; wine confidence rating; millennial wine consumers; ethnicity

1. Introduction

Consumer preferences for food and beverages are a complex interaction of sensory (taste, odor, texture, etc.) and non-sensory (origin, brand, etc.) factors [1]. These factors are important components in the development of consumers' appreciation of and subsequent purchases and consumption of wine.

Interestingly, wine preferences and appreciation often have a multigenerational component, where patterns of behavior and knowledge are passed from older family members to younger family members, as part of the sociocultural norms [2]. These sociocultural norms establish the foundation for the consumers' familiarity, expectations and attitudes about wine. It has been observed that in European countries such as France, Spain, Germany and Italy, consumers are exposed to wine at an early age as part of social, dietary and cultural traditions. Often young children in these European countries may be given a small amount of wine with meals regularly at early age, in order to include children in the family traditions.

Since the drying, bitter, astringent and alcoholic sensations associated with wine are often rejected on inception by children and neophytes [3,4], adults dilute their children's wine with water to minimize any adverse responses. Both children and adults learn to accept the sensations with repeated exposure, peer pressure and positive reinforcement [3]. The frequency of exposure and/or time frame for acquisition of acceptance is likely to be highly variable and dependent upon diversity within the many factors mentioned above. Consumers learn iteratively through their diverse experiences and progressively adjust their expectations and acceptance level with each experience.

In some countries such as China, Japan, Korea, Vietnam and India, the consumption of wines is not typically part of the sociocultural norm. Therefore, wine knowledge and appreciation must be acquired through a proactive approach. One option may be for consumers to seek wine information and/or wine education classes in order to understand how to select a wine for consumption, special occasions or gift giving.

As North America (NA) has become increasingly multicultural, young consumers in NA are from diverse ethnic backgrounds. Consumer research has been conducted to explore the influence of cross-cultural differences and evaluate consumers' attitudes, preferences and beliefs in order to gain insight into the marketplace [1]. Do et al. [5] documented that the French consumed wine primarily for the sensorial pleasures and the emotions it may evoke, while Vietnamese participants consumed wine primarily for social, prestige and medicinal reasons. Hence, there may be strong cultural influences, however, differences in consumption patterns might be linked also in part to physiological differences in sensitivity to bitterness [6,7] or alcohol [8].

Consumer preferences are influenced not only by the sensory stimuli (aroma, taste, flavor) but cognitive information (packaging, brand, vintage, appellation, country-of-origin) [9]. Researchers have evaluated the effects of intrinsic characteristics of wine (e.g., grape variety, alcohol content, region-of-origin), as well as the extrinsic characteristics (e.g., price, packaging, brand, closure type) in order to understand/model consumer wine selection [10]. Such market research may quantify consumers' responses at a given point in time and provides some insights, but often cannot address completely the dynamic nature of wine preference [9].

Although the food industry is constantly developing new products to meet consumers' needs, the wine industry is just exploring how this may be done [9] in order to be more successful in the marketplace. With the changing demographics and sociocultural influences in the North American marketplace, there is a need for the wine industry to better understand the needs and preferences of consumers. In particular, there is little formal quantitative information on the type and change in wine preferences in response to wine education and sensory training. Moreover, it is not well understood how and when such training may influence consumer wine preferences over the short and long term.

Therefore, the goal of this preliminary research was to evaluate the influence of wine education and training on wine hedonic (preference) and confidence ratings of a diverse group of young consumers at the beginning of their putative early development period of wine consumption. This research was implemented using a collection of five British Columbian (BC) wines and young wine consumers, who were registered in a 12-week wine education course.

2. Materials and Methods

2.1. Wines

Five BC commercial wines (Ehrenfelser, Chardonnay, rosé, Pinot noir, Cabernet-Merlot) were evaluated. These wines were selected to represent five distinctly different wine styles (sweet white, dry white, rosé, light red, full-bodied red) available in the marketplace. All wines were BC-VQA wines and were defect free. They were approximately equal in quality and similar in price, ($17.95/bottle–$22.95/bottle), expressed in Canadian (CDN) dollars. The rosé wine was prepared from a blend of Gamay and Ehrenfelser. The white and rosé wines were from the 2007 vintage and had an alcohol content of ~11%–12%; whereas the red wines were from the 2006 vintage and had an alcohol content of ~13%–14%, as reported on the wine labels. The sweetness of the wines using the BC Liquor Board sweetness code (1–10) [11] was as follows: Ehrenfelser, 2; Chardonnay, 0; rosé, 2; Pinot noir, 0; Cabernet-Merlot, 0. The codes of 0 and 1–2 corresponded with residual sugars of 0–5 g/L (very dry) and 5–25 g/L (off-dry), respectively. All wines were purchased from the BC Wine Information Centre (Penticton, BC, Canada) and stored at 15 °C until required.

2.2. Consumers

Participants for the study were recruited from the registrants (n = 178) in an undergraduate University of British Columbia (UBC) wine science course (FOOD 330) held January to April 2008. Participation was voluntary and no incentives were given. The course consisted of one 2-h lecture and one 1-h tasting session per week. The lecture material provided an overview of: wine history, viticulture and terroir, enological practices, aroma and flavor description, wines of the world and the role of wine in society and health. The laboratory provided hands-on familiarity with ~2–3 wines per week, for a total of 10-weeks. It exposed students to a broad range of "old" and "new" world wines including sparkling wines, white and red varietal wines, red blends and dessert/specialty wines. While the course was 12-weeks in duration, the students were exposed to a total of ~7-h of formal wine tasting training; however, they were encouraged to practice on their own. Assessments took place as part of the regular laboratory sessions, in the first (week 1) and twelfth week (week 12) of the semester. The assessments were overseen by experimenters and teaching assistants, who implemented the experimental protocol in eight laboratory sessions, consisting of 15–25 students each. Each participant was given a consumer number, which was used to uniquely and confidentially identify their questionnaires.

2.3. Experimental Design/Sensory Protocol

All wines were tasted using a standardized tasting protocol adapted from Baldy [12]. Participants were seated at individual stations to complete the questionnaires and conduct the assessments. Each station was equipped with a rinse cup, spittoon and five International Standards Organisation (ISO) wine glasses labeled with random color codes. Prior to the assessments, wine samples (30 mL) were poured by the experimenters into the ISO glasses at the tasting stations and arranged according to a completely balanced design (n = 50) [13]. A balanced design ensured that each wine was tasted in each position the same number of times. The exact protocol was used for the initial (week 1) and final (week 12) assessments, with the exception that new random (color) codes were utilized in the final assessment and glasses were placed in a different random orders.

2.4. Questionnaires

Prior to the wine education (week 1), participants completed a wine survey and two sensory ballots (hedonic, confidence). The assessment in the twelfth week was identical to that in the first, with the exception that consumers did not fill out another wine survey. A total of 133 students completed the survey and both ballots.

2.4.1. Wine Survey

The wine survey consisted of four demographics questions. Participants identified their gender (female, male) and age (<21 years, 21–23 years, 24–27 years, >27 years) by checking the appropriate categories. Since there was an extremely low number of participants in the upper age category (>27 years), consumers in this age category were combined with those in the 24–27 years category. Consumers also identified their ethnicity (country-of-family-origin). Responses were categorized as follows: North America (Canada, United States of America), Europe (UK, France, Germany, Italy, Spain, Poland, Romania) and Asia (China, Hong Kong, Taiwan, South Korea, Vietnam, Indonesia, Japan, Philippines, Singapore) and the remaining 10 respondents were classified as "other". There were only three respondents from Middle East and seven respondents from South/Central America; due to insufficient numbers these consumers were dropped from the tests involving ethnicity. Consumers also identified their faculty of study (Art, Science, other). Preliminary evaluation of the data revealed that age, gender and faculty were not a significant source of variation and were dropped from further statistical analyses.

Consumers indicated their frequency-of-selection for each of the wine types (full-bodied red, light red, dry white, sweet wine, sparkling, dessert, rosé) on a 5-point scale with the following categories: "never", "rarely", "sometimes", "often" and "most-of-the-time".

Consumers answered survey questions relating to their frequency-of-purchase, frequency-of-consumption, willingness-to-pay and wine knowledge on 5-point scales. The response options for these variables .were as follows: frequency-of-purchase ("rarely", "1–3×/year", "4–6×/year", "7–9×/year", ">10×/year"), frequency-of-consumption ("rarely", "1–3 glasses/month", "1–2 glasses/week", "3–4 glasses/week", ">5 glasses/week"), frequency-of-purchase of Canadian wine ("rarely", "1–3×/year", "4–6×/year", "7–9×/year", ">10×/year"), willingness-to-pay (price/bottle) ("<$10/bottle", "$11–$14/bottle", "$15–$18/bottle", "$19–$23/bottle", ">$23/bottle") and wine knowledge ("limited knowledge", "slightly knowledgeable", "moderately knowledgeable", "highly knowledgeable", "extremely knowledgeable").

Consumers also were asked to provide reasons for their wine consumption ("social", "part-of-a-meal", "other"), indicate if they were aware of the Vintners Quality Alliance (VQA) Program and specify if they knew difference between wines labelled "produced from grapes grown in Canada" and those labelled "bottled and cellared in Canada" and if they had prior wine education, on 3-point scales.

Survey questions were quantified by assigning numerical values to the responses, as per the number of response categories. Since most of the underlying variables (frequency-of-consumption, frequency-of-purchase, willingness-to-pay, wine-knowledge, wine education) were ordinal in nature, data were analyzed by non-parametric statistics.

2.4.2. Sensory Ballots (Hedonic and Confidence Ratings)

Sensory ballots consisted of a 9-point hedonic (degree-of-liking) and 5-point confidence (degree-of-sureness) ordinal scales. Participants were asked to provide hedonic assessments for the following wine characteristics: (i) visual appearance; (ii) aroma and (iii) flavor. The 9-point scale consisted of the following categories: "dislike extremely, "dislike highly", "dislike moderately", "dislike slightly", "neither like nor dislike", "like slightly", "like moderately", "like highly" and "like extremely"; whereas the 5-point confidence scale was anchored with: "not sure", "slightly sure", "moderately sure", "highly sure" and "extremely sure". The use of confidence scales in combination with hedonic scales has not previously been reported in the literature; however, it was hoped that such an approach would introduce a new perspective in the understanding of wine preferences. Consumer ballots were identified as before and after wine education (week 1, week 12), consumer number (1–133), age (<21 years, 21–23 years, >23 years), gender (female, male), ethnicity and faculty, as described above. Participants who did not respond to the classification criteria were dropped from the data set.

2.5. Statistical Analysis

2.5.1. Wine Survey

Consumer demographics were collected on all consumers; however, more detailed statistical analyses were conducted on the largest subgroups of consumers (North American (NA), n = 38; European (EU), n = 31; Asian, n = 54). Response frequencies were tabulated for each of the survey questions: frequency-of-purchase, frequency-of-consumption, willingness-to-pay, wine knowledge, wine education, aware-of-VQA and knowledge-of-labeling, and expressed as percent. Since the survey scales were categorical in nature, Chi-square tests (χ^2) were utilized to evaluate the pattern of responses among subgroups of consumers with different ethnicities. For ordinal variables, response frequencies were evaluated for NA, EU and Asian consumers using Kruskal Wallis tests, followed by Mann-Whitney tests.

Consumers' frequency-of-selection for the different wine types was evaluated using a Friedman test followed by a Wilcoxon Signed Rank test. The frequency-of-purchase of different wine types, for consumers from different ethnicities, was also evaluated using Kruskal Wallis tests followed by Mann-Whitney tests.

Spearman correlation coefficients (r_s) were calculated to investigate the relationship between the level of wine knowledge of consumers prior to taking the wine course to their hedonic and confidence ratings, frequency-of-purchase, frequency-of-consumption and willingness-to-pay for wines in week 1 of their wine training.

2.5.2. Sensory Ballots: Hedonic and Confidence Ratings

Non-parametric statistics were used to analyze the data from the hedonic and confidence scales. This is consistent with the fact that the scales are described as ordinal in nature [14]. While examples can be found in the literature, where researchers have applied parametric statistics to 9-point hedonic scale data, they have done so at the expense of violating the underlying assumptions [14]. Nevertheless, normality tests were performed; they confirmed the non-normality of the data (data not shown). In fact, non-parametric statistics are not necessarily less powerful than parametric statistics, particularly when the assumptions of parametric tests are not met [15].

Kruskal Wallis and Mann-Whitney tests were used to evaluate the effects of faculty, gender and age on the hedonic and confidence ratings. Due to the non-significant results (data not shown), the variables faculty, age and gender were dropped from further statistical evaluation. Without age and gender as variables, the ethnicity variable was used to evaluate the effects of wine education on the hedonic (visual, aroma, flavor) and confidence (visual, aroma, flavor) ratings using Wilcoxon Signed Rank tests, for each of the five wines. Mean hedonic and confidence ratings were plotted on cobweb-like diagrams. To aid in visualization, the minimum and maximum values for the axes were adjusted [hedonic scale (min. = 4, max. = 8); confidence scale (min. = 2, max. = 5)].

Means and standard deviations were reported for all variables associated with the survey and sensory ballots. All statistical analyses were conducted using the PASW Statistics software (IBM SPSS Statistics, Version 20.0, IBM Corp., Armonk, NY, USA).

3. Results and Discussion

3.1. Wine Survey

3.1.1. All Consumers

Consumers in the research were 65.4% female (n = 87) and 34.6% male (n = 46). Sixty-seven percent (n = 77) were between the ages of 21–23 years of age, with an additional 11.4% (n = 13) and 21.1% (n = 24) under 21 or over 23 years of age, respectively. The country-of-family-origin for the consumers was: 43.9% Asia (n = 54), 30.9% North America (n = 38), 25.2% Europe (10.6% United Kingdom (n = 14), 6.8% Western Europe (n = 9), 6.1% Eastern Europe (n = 8) and 7.5% other [5.3% Central/South America

(n = 7), 2.2% Middle East (n = 3)]. It should be noted that the NA, EU and Asian consumers in this research refer to the participants' country-of-family-origin or ancestry. Such a classification established the participants' ethnicity, without confounding it with their residency or citizenship. However, such a classification did not differentiate participants by the length of time they or their family had resided outside their ancestral homeland.

Sixty-one percent of consumers reported they had "limited knowledge" about wine. Another 9.4% of consumers reported they had "moderate knowledge" about wine; this was the highest level of wine knowledge reported by consumers prior to taking the wine education course. Twenty-six percent of consumers reported that they "never" or "rarely" consumed wine. Consumers in this research had wine consumption that was substantially below the reported national average (7.8 liters/year) [16]. Approximately one-third (37.6%) of consumers reported consuming "1–3 glasses/month", while an additional 21.8% consumed wine "1–2 glasses/week". Fifty-six percent of consumers stated they consumed wine for "social reasons", while 37.7% stated they consumed wines primarily as "part-of-a-meal".

Consumers varied considerably in the type of wine selected (Table 1). In general, rosé and dessert wines were selected least frequently, with the majority of consumers (69.0% and 61.4%, respectively) selecting these wines either "never" or "rarely". Sparkling wines were also selected infrequently, with 55.6% of consumers selecting them "never" or "rarely". Light red and dry white wines were selected more frequently than rosé wines, with consumers' responses distributed amongst the "never", "rarely", "sometimes" and "often" categories (Table 1).

Table 1. Consumers' frequency-of-selection for different wine types.

Response Category	No. of Consumers	Frequency of Response (Percent) [a]					Friedman Test [b]	Mean Response Frequency	
Wine Type	n	Numerical Score for Category						Mean [c,d]	Standard Deviation
		1	2	3	4	5			
		Never	*Rarely*	*Sometimes*	*Often*	*Most-of-the-Time*			
Rosé	126	36.5	32.5	19.0	9.5	2.4		2.09e	1.07
Dessert	127	28.3	33.1	18.1	13.4	7.1		2.38de	1.23
Sparkling	126	22.2	33.3	25.4	13.5	5.6		2.47d	1.14
Light red	127	21.3	23.6	26.0	22.8	6.3	76.31 ***	2.69cd	1.22
Dry white	124	16.1	23.4	25.0	24.2	11.3		2.91bc	1.26
Sweet white	128	16.4	25.0	21.9	13.3	23.4		3.02ab	1.41
Full-bodied red	129	13.2	20.9	15.5	18.6	31.8		3.35a	1.44

[a] Percent of consumers for each type of wine; [b] Friedman test value followed by *** indicate significance at $p \leq 0.001$; [c] mean values arranged in ascending order; [d] mean values followed by different superscripts (a–e) are significantly different ($p \leq 0.05$) according to the Wilcoxon Signed Rank test.

In contrast, the response pattern was very different for the sweet white and full-bodied red wines. Consumers selected sweet whites either "never" or "rarely" (41.4%) or "often" or "most-of-the-time" (36.7%) (Table 1). This apparent split response suggested that there may have been two subgroups amongst the consumers tested—those who frequently and those who infrequently consumed sweet white wines. This result is consistent with the fact that, there was also a group of participants (50.4%, n = 65), who indicated that they selected red wines "often" or "most-of-the-time".

3.1.2. North American, European and Asian Consumers Only

Response frequencies to the survey questions were significantly different for the Asian (n = 54), European (n = 31) and North American (n = 38) consumers (Table 2). NA and EU consumers purchased wine more frequently, with means of 4.32 and 4.00 respectively, than Asian consumers with a mean rating of 1.98. This difference is reflected in the response distributions (Table 2), with 63.2% of NA and 58.1% of EU consumers purchasing wine ">10× per year", compared to 75.9% of Asian consumer who purchased wine either "rarely" or "1–3× per year". Consumers from all groups (NA, EU, Asian) purchased wines of Canadian origin less frequently than wines from other countries, as reflected by the mean responses of 3.34, 2.08 and 1.52, respectively (Table 2).

Table 2. Frequency of responses to survey questions for consumers of different ethnicities.

Question	Consumer Ethnicity	No. of Consumers	Frequency of Response (Percent) [b]					Kruskal Wallis Test [c]	Mean Response Frequency	
	Country-of-Family-Origin [a]	*n*	Numerical Score for Category						Mean [d]	Standard Deviation
			1	2	3	4	5			
Q1. Frequency-of-purchase			*Rarely*	*1–3×/year*	*4–6×/year*	*7–9×/year*	*>10×/year*			
	North America	38	2.6	5.3	13.2	15.8	63.2		4.32a	1.07
	Europe	31	9.7	9.7	9.7	12.9	58.1	52.63 ***	4.00a	1.41
	Asia	54	44.4	31.5	14.8	0.0	9.3		1.98b	1.21
Q2. Frequency-of-consumption			*Rarely*	*1–3 glasses/month*	*1–2 glasses/week*	*3–4 glasses/week*	*>5 glasses/week*			
	North America	38	5.3	31.6	36.8	13.2	13.2		2.97a	1.10
	Europe	31	3.2	35.5	35.5	19.4	6.5	49.32 ***	2.90a	0.98
	Asia	54	53.7	38.9	3.7	3.7	0.0		1.57b	0.74
Q3. Frequency-of-purchase of Canadian wine			*Rarely*	*1–3×/year*	*4–6×/year*	*7–9×/year*	*>10×/year*			
	North America	38	13.2	26.3	10.5	13.2	36.8		3.34a	1.53
	Europe	30	23.3	26.7	20.0	6.7	23.3	37.30 ***	2.80a	1.49
	Asia	54	63.0	27.8	5.6	1.9	1.9		1.52b	0.84
Q4. Willingness-to-pay (price/bottle) [e]			*<$10/bottle*	*$11–$14/bottle*	*$15–$18/bottle*	*$19–$23/bottle*	*>$23/bottle*			
	North America	37	2.7	32.4	43.2	10.8	10.8		2.95b	1.00
	Europe	30	3.3	33.3	40.0	13.3	10.0	12.40 **	2.93b	1.02
	Asia	52	0.0	11.5	38.5	30.8	19.2		3.58a	0.94
Q5. Wine knowledge			*limited knowledge*	*slightly knowledgeable*	*moderately knowledgeable*	*highly knowledgeable*	*extremely knowledgeable*			
	North America	36	38.9	44.4	16.7	0.0	0.0		1.78a	0.72
	Europe	30	46.7	43.3	10.0	0.0	0.0	18.30 ***	1.63a	0.67
	Asia	52	82.7	11.5	5.8	0.0	0.0		1.23b	0.55

[a] Classification by country-of-family-origin was as follows: North America (Canada, United States of America), Europe (UK, France, Germany, Italy, Spain, Poland, Romania) and Asia (China, Hong Kong, Taiwan, South Korea, Vietnam, Indonesia, Japan, Philippines, Singapore). This classification established ethnicity of the participants, without confounding it with their residency or citizenship; [b] percentage of consumers within group; [c] Kruskal Wallis test values followed by ** and *** indicate significance at $p \leq 0.01$ and $p \leq 0.001$, respectively; [d] Means with different superscripts (a–b) are different ($p \leq 0.05$) according to the Mann-Whitney test; [e] the prices listed (<$10, $11–$14, $15–$18, $19–$23, >$23/bottle) are those utilized at the time of the survey (2008) and correspond to ~<$11, $12–$16, $20–$23, $22–$26 and >$26/bottle in 2016 dollars, respectively.

As shown on Table 2, Asian consumers purchased and consumed ($\bar{x}_{purchased}$ = 1.98, $\bar{x}_{consumed}$ = 1.57) wine less frequently than EU ($\bar{x}_{purchased}$ = 4.00, $\bar{x}_{consumed}$ = 2.90) and NA ($\bar{x}_{purchased}$ = 4.32, $\bar{x}_{consumed}$ = 2.97) consumers. However, Asian consumers were willing to pay significantly ($p \leq 0.05$) more for a bottle of wine ($\bar{x}$ = 3.58; \$15–\$23/bottle) than EU and NA consumers ($\bar{x}$ = 2.95–2.93; \$11–\$18/bottle); these values correspond to ~\$17–\$26/bottle and ~\$12–\$20/bottle, when converted to 2016 CDN dollars using an online calculator [17]. Close examination of the response frequencies (Table 2) suggested that 69.3% of Asian consumers would pay this higher price, while an additional 19.2% were willing to pay more than \$23/bottle, corresponding to >\$26/bottle in 2016 CDN dollars (Table 2).

NA and EU consumers indicated that they were "slightly" to "moderately" knowledgeable about wine; whereas, the majority of Asian consumers (82.7%) reported their knowledge to be "limited" (Table 2). This was consistent with the fact that a higher proportion of Asian consumers (96.2%) had not previously taken some type of wine education, compared to NA (75.7%) and EU (89.7%) consumers. This, in combination with the fact that a large portion of these Asian consumers "rarely" purchased or consumed wine, reflected that the Asian participants in this research were a particularly novice group of consumers; such findings were confirmed with the course's instructor.

The ethnicity of the respondents and their reasons for wine consumption were not independent from each other [χ^2 (2, n = 120) = 17.21, $p \leq 0.01$]. Asian consumers indicated they consumed wine primarily for "social reasons" (65.4%) and to a lesser extent as "part-of-a-meal" (34.6%). EU consumers also consumed wine for "social reasons" (63.3%) and as "part-of-a-meal" (26.7%). In contrast, NA consumers were more likely to consume wine as "part-of-a-meal" (52.6%) compared to consuming it for "social reasons" (34.2%). Such findings are consistent with Olsen et al. [18] who report that American consumers agree highly with the statement that "wine fits better with food".

A higher percentage of NA and EU consumers (59.5% and 53.3% respectively) were aware of the Vintners Quality Assurance (VQA) program for Canadian wine, compared to Asian consumers (31.5%) [χ^2 (2, n = 121) = 7.93, $p \leq 0.05$]. NA and EU consumers were more likely to be aware (42.3% and 45.2%, respectively) of the difference between wines "made from grapes grown in Canada" and those "cellared and bottled in Canada", compared to Asian consumers (17.6%) [χ^2 (2, n = 122) = 9.64, $p \leq 0.01$].

NA, EU and Asian consumers also differed significantly in the frequency-of-selection of the different wine types (Table 3). The mean responses for the NA consumers for the full-bodied red, light red and dry white wines were 3.95 ("often"), 2.81 ("sometimes") and 3.11 ("sometimes"), respectively. The mean responses for the EU consumers for the same wine types were 3.47, 3.10 and 3.55, respectively, corresponding to ratings between "sometimes" and "often". These responses are all higher than the responses from the Asian consumers, which were 2.92, 2.27 and 2.41, respectively, corresponding to ratings between "rarely" and "sometimes" (Table 3). However, the EU consumer response, for frequency-of-selection of full-bodied red wines, was not significantly different from either the NA or Asian consumers. Upon examination of the frequency distribution, a relatively large sub-group of NA consumers (44.7%) selected full-bodied reds "most-of-the-time". Again this suggests there might have been a sub-group of more experienced wine consumers who participated in the study. In contrast, Asian consumers mean responses for the dessert and sweet white wines were 3.00 and 2.92, respectively (Table 3). These responses were significantly higher than the responses by the NA consumers ($\bar{x}_{dessert}$ = 2.14; $\bar{x}_{sweet\ white}$ = 2.61). Such responses are consistent with the fact that Asian consumers, as well as female and younger consumers typically prefer white wines [19,20]. Asian consumers also selected dessert wines ($\bar{x}_{dessert}$ = 3.00) more frequently than EU consumers ($\bar{x}_{dessert}$ = 1.76), but their selection of sweet white wines ($\bar{x}_{sweet\ white}$ = 2.92) was not significantly different from that of EU consumers ($\bar{x}_{sweet\ white}$ = 3.43) (Table 3). In contrast, rosé and sparkling wines were selected at a similar low frequency by NA, EU and Asian consumers, as reflected by the mean response that were not significantly different ($p > 0.05$) (Table 3). Similar results were reported for rosé and sparkling wines for US and Australasian consumers [21].

Table 3. Frequency of selection of different wine types for consumers of different ethnicities.

Response Category	Consumer Ethnicity	No. of Consumers	Frequency of Response (Percent) [c]					Kruskal Wallis Test [d]	Mean Response Frequency	
			Numerical Score for Category							
Wine Type [a]	Country-of-Family-Origin [b]	*n*	1	2	3	4	5		Mean [e]	Standard Deviation
			Never	*Rarely*	*Sometimes*	*Often*	*Most-of-the-Time*			
Rosé	North America	36	36.1	38.9	16.7	8.3	0.0	0.96	1.97	0.94
	Europe	30	23.3	50.0	16.7	3.3	6.7		2.20	1.06
	Asia	51	47.1	17.6	21.6	11.8	2.0		2.04	1.17
Dessert	North America	36	27.8	36.1	30.6	5.6	0.0	18.25 ***	2.14b	0.90
	Europe	29	37.9	48.3	13.8	0.0	0.0		1.76b	0.69
	Asia	53	18.9	22.6	15.1	26.4	17.0		3.00a	1.40
Sparkling	North America	36	16.7	33.3	44.4	5.6	0.0	0.77	2.39	0.84
	Europe	30	23.3	43.3	13.3	16.7	3.3		2.33	1.12
	Asia	50	28.0	24.0	18.0	18.0	12.0		2.62	1.38
Light red	North America	36	19.4	22.2	25.0	25.0	8.3	9.92 **	2.81a	1.26
	Europe	30	6.7	20.0	36.7	30.0	6.7		3.10a	1.03
	Asia	51	33.3	29.4	17.6	15.7	3.9		2.27b	1.20
Dry white	North America	36	11.1	22.2	25.0	27.8	13.9	16.24 ***	3.11a	1.24
	Europe	29	3.4	13.8	27.6	34.5	20.7		3.55a	1.09
	Asia	49	26.5	30.6	22.4	16.3	4.1		2.41b	1.17
Sweet white	North America	36	19.4	41.7	16.7	2.8	19.4	6.04 *	2.61b	1.38
	Europe	30	6.7	20.0	26.7	16.7	30.0		3.43a	1.30
	Asia	52	21.2	21.2	23.1	13.5	21.2		2.92ab	1.44
Full-bodied red	North America	38	5.3	10.5	13.2	26.3	44.7	11.31 ***	3.95a	1.23
	Europe	30	6.7	20.0	23.3	20.0	30.0		3.47ab	1.31
	Asia	51	19.6	27.5	15.7	15.7	21.6		2.92b	1.45

[a] Wine types arranged as in Table 1; [b] classification by country-of-family-origin was as follows: North America (Canada, United States of America), Europe (UK, France, Germany, Italy, Spain, Poland, Romania) and Asia (China, Hong Kong, Taiwan, South Korea, Vietnam, Indonesia, Japan, Philippines, Singapore). This classification established ethnicity of the participants, without confounding it with their residency or citizenship; [c] percentage of consumers within group; [d] Kruskal Wallis test values followed by *, **, *** indicate significant at $p \leq 0.05$, $p \leq 0.01$ and $p \leq 0.001$, respectively; [e] means followed by different subscripts (a–b) are significantly different according to the Mann-Whitney test at $p \leq 0.05$.

3.1.3. Correlation between Prior Wine Knowledge and Purchase/Consumption Frequencies

The consumers' level of wine knowledge was positively correlated, at $p \leq 0.05$, to wine purchase frequency ($r_s = 0.51$, n =133), wine consumption frequency ($r_s = 0.49$, $n = 133$), but not willingness-to-pay ($r_s = -0.09$, $n = 133$).

For Asian consumers, where wine is not traditionally part of their culture, there was a positive correlation between their level of wine knowledge and their wine purchase frequency ($r_s = 0.44$, $n = 54$) and consumption frequency ($r_s = 0.47$, $n = 54$) at $p \leq 0.05$. In contrast for NA consumers, there was a positive correlation between their level of wine knowledge and their purchase frequency ($r_s = 0.50$, $n = 38$), but not with their wine consumption frequency ($r_s = 0.33$, $n = 38$) at $p \leq 0.05$. Whereas for EU consumers, where wine is traditionally part of their culture, there was not a significant correlation between consumers' level of wine knowledge with either their wine purchase frequency ($r_s = 0.17$, $n = 31$) nor with their wine consumption frequency ($r_s = 0.22$, $n = 31$) at $p \leq 0.05$. Frøst and Noble [22] report that differences among individuals can be large and are more important than mere wine knowledge in determining wine preferences. However, much remains to be understood, particularly in relation to how consumers of different ethnicities use subjective versus objective knowledge [23].

3.2. Sensory Ballot: Hedonic Ratings

3.2.1. Effects of Education and Wine Type

Consumer preferences were influenced by wine education and wine type (Table 4). Interestingly, hedonic visual ratings did not change significantly over the 12-week training period, except forthe Chardonnay wine ($\bar{x}_{week1} = 6.56$, $\bar{x}_{week12} = 7.15$) (Table 4). This increase was believed due to the fact that consumers learned to recognize the distinctive golden color of the oaked Chardonnay and appreciate it more. Such findings are consistent with Cardello [24], who reported that consumers adjust their food acceptability (ratings) to match their new or existing expectations. This lack of change of the visual preferences for the other wines, suggests visual characteristics may simply not be as relevant to wine consumers, who are believed to be more interested in aroma and flavor characteristics.

In contrast, the mean hedonic aromas and flavor ratings did change significantly over the 12-week educational period (Table 4). Consumers' aroma and flavor hedonic ratings increased for the white (Ehrenfelser, Chardonnay) and rosé wines, (Table 4), but not the red wines (Cabernet-Merlot, Pinot noir) at $p \leq 0.05$ (Table 4).

The high hedonic flavor ratings for the Ehrenfelser and rosé wines (Table 4) were attributed to their "pleasant" fruity sweet characters. It was not surprising the rosé wine evoked a similar response as the Ehrenfelser wine, since this wine was a blend of Gamay and Ehrenfelser wines. In contrast, the low hedonic flavor ratings for the Chardonnay wine ($\bar{x} = 5.15$) (Table 4) were attributed to its relatively dry, oaky characteristics. While these characteristics are representative of this type of wine, they are often less appealing to novice wine consumers [3]. The greatest increases in hedonic ratings over the training period were observed for the sweet fruity wines (Ehrenfelser, rosé) (Table 4). This suggested that consumers' preexisting preferences for sweet and fruity wines were enhanced after their education/training—possibly due to their newly acquired aroma/flavor recognition skills. While the consumers' degree of improvement was not evaluated, such a metric could be included in further research.

In general, the hedonic aroma and flavor ratings were lower for the red wines than white/rosé wines, on the first and twelfth week (Table 4). Possibly the young consumers found the aromatics for the white/rosé wines more "pleasant", compared to those of the red wines. While this may have been due to the specific aromas and flavors of the wines evaluated, it might also have been attributed to fact that red wines with their different balance or type of aroma/flavor complexity, were more difficult for novice consumers to evaluate. For example, the Cabernet-Merlot wine had a more forward (dominant) oak character that could have obscured or masked the underlying fruit aromas. Consumers might also

have anticipated the presence of bitterness, astringency and/or alcoholic sensations that could have dampened their hedonic ratings.

Table 4. Mean hedonic and confidence ratings for each wine characteristic (visual, aroma, flavor) for each of the five wines, for all respondents, before and after wine education.

Sensory Ballot	Wine Characteristic/Wine	No. of Consumers	Before Wine Education (week 1)		After Wine Education (week 12)		Wilcoxon Signed Rank Test [a]
		n	Mean	Standard Deviation	Mean	Standard Deviation	
Hedonic Ratings	Visual Ehrenfelser	133	6.53	1.57	6.64	1.48	−0.78
	Aroma Ehrenfelser	133	6.63	1.69	7.41	1.51	−4.50 ***
	Flavor Ehrenfelser	124	6.31	1.83	7.07	1.15	−3.93 ***
	Visual Chardonnay	133	6.56	1.49	7.15	1.25	−3.84 ***
	Aroma Chardonnay	133	6.13	1.84	6.84	1.51	−3.66 ***
	Flavor Chardonnay	124	5.31	1.85	5.96	1.67	−3.08 **
	Visual rosé	134	6.13	1.89	6.25	1.82	−0.03
	Aroma rosé	133	6.44	1.72	6.86	1.59	−2.32 *
	Flavor rosé	122	5.84	2.03	6.51	1.50	−2.86 **
	Visual Pinot noir	132	6.92	1.63	7.05	1.58	−1.20
	Aroma Pinot noir	132	5.91	1.81	5.84	1.93	−0.42
	Flavor Pinot noir	115	5.33	2.17	5.32	2.08	−0.19
	Visual Cabernet-Merlot	133	6.74	1.41	6.50	1.52	−1.88
	Aroma Cabernet-Merlot	132	5.99	1.68	5.95	1.86	−0.03
	Flavor Cabernet-Merlot	117	5.09	2.11	5.26	1.89	−0.60
Confidence Ratings	Visual Ehrenfelser	133	3.64	0.96	4.30	0.72	−6.46 ***
	Aroma Ehrenfelser	133	3.73	0.94	4.35	0.67	−6.40 ***
	Flavor Ehrenfelser	122	3.59	1.00	4.25	0.73	−6.08 ***
	Visual Chardonnay	132	3.67	0.95	4.34	0.66	−6.49 ***
	Aroma Chardonnay	133	3.62	0.89	4.31	0.62	−7.05 ***
	Flavor Chardonnay	119	3.62	0.86	4.27	0.74	−6.20 ***
	Visual rosé	133	3.69	1.05	4.32	0.76	−6.04 ***
	Aroma rosé	133	3.71	0.94	4.33	0.65	−6.70 ***
	Flavor rosé	121	3.50	0.97	4.24	0.72	−6.21 ***
	Visual Pinot noir	132	3.67	0.97	4.30	0.74	−6.29 ***
	Aroma Pinot noir	132	3.52	0.99	4.29	0.70	−6.95 ***
	Flavor Pinot noir	115	3.50	0.92	4.26	0.69	−6.75 ***
	Visual Cabernet-Merlot	133	3.65	0.93	4.27	0.69	−6.17 ***
	Aroma Cabernet-Merlot	132	3.53	0.97	4.19	0.73	−6.34 ***
	Flavor Cabernet-Merlot	117	3.68	0.93	4.15	0.62	−4.82 ***

[a] Wilcoxon Signed Rank tests followed by *, **, *** indicate significance at $p \leq 0.05$, $p \leq 0.01$ and $p \leq 0.001$ respectively.

The results are consistent with Lesschaeve [9] who found that sweet wines are preferred by consumers when evaluations are conducted without extrinsic clues (wine label information). Lesschaeve [9] also suggested that the lower hedonic rating for red wines might be in part due to the method of evaluation, since red wines are usually consumed with food.

Regardless of the explanation, consumers' hedonic ratings for the red wines were unchanged over the 12-week period, despite the participants' improved ability to discern and identify the aromas/flavors. The findings, nevertheless, are consistent with the fact that modification of food preferences are difficult to change [25] and that the appreciation of a wine with a bitter and/or astringent characters would require repeated exposure, under positive and pleasant conditions [26]. Possibly the time period and frequency of exposure to the red wines were simply too short to promote an enhanced appreciation. Although wine education has been identified as a primary catalyst for a change in preference [27], there was no evidence in this research to suggest that consumers would shift their preferences from one style to another (e.g., sweet white wines to dry oaked red wines). Nevertheless, the findings are consistent with Frøst and Noble [22] who showed that individual

preferences' play a larger role in determining wine liking (hedonic ratings) than mere level of wine knowledge or the ability to describe a wine (sensory expertise).

However, anecdotal evidence suggests that consumers might "trade-up" and purchase a wine of higher quality (higher price), as the direct result of their newly acquired wine knowledge and/or involvement with wine tasting [23,24]. Jaeger et al. [28] reported that consumers with greater involvement with wine were more likely to rely on their knowledge (grape variety, brand, region) rather than the merchandizing (pricing, advertising, packaging) to select a wine. To this end, the wine education provided in this study would likely add to these consumers' cumulative positive wine experience and contribute to changes in wine preference in the long term [26].

3.2.2. Effects of Ethnicity, Education and Wine Type

Significant differences in hedonic ratings (visual, aroma, flavor) were observed among consumers of different ethnicities, before and after wine education (Figure 1A,B). While little or no differences were observed for the white and rosé wines, significant differences were observed for red wines (Figure 1A,B).

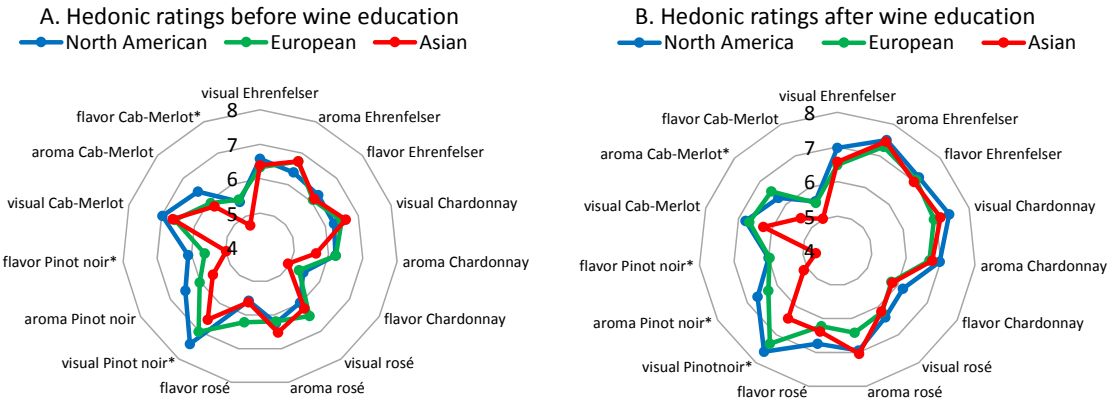

Figure 1. Mean hedonic ratings (degree-of-liking, max. = 9) before (**A**) and after (**B**) 12-weeks of wine education/training, for North American, European and Asian consumers. Means identified with an asterisk (*) are significantly different ($p \leq 0.05$) according to Kruskal Wallis tests followed by Mann-Whitney tests. Tests were conducted on each wine characteristic (visual, aroma, flavor) for each of the five wines. The minimum and maximum axes values were specified as four and eight, respectively, to aid in visualization.

In general, Asian consumers had lower means ratings for the red wines compared to NA consumers, who were similar to the EU consumers, with few exceptions—as exemplified by the mean ratings for Cabernet-Merlot and Pinot noir by Asian ($\bar{x}_{\text{Cabernet-Merlot}} = 5.64$, $\bar{x}_{\text{Pinot noir}} = 5.55$) and NA ($\bar{x}_{\text{Cabernet-Merlot}} = 6.25$, $\bar{x}_{\text{Pinot noir}} = 6.72$) consumers.

These results are consistent with the findings of Somogyi et al. [29] who reported that Asian consumers prefer sweet wines—even those adulterated with lemonade, over dry wines. Interestingly NA and EU consumers have similarly high ratings for the sweet fruity wines, but were more accepting of the full-bodied red wines (Figure 1A,B). Such findings are consistent with data provided by the demographic wine survey (Table 3), that there were possibly two subgroups of NA and EU consumers: those who frequently selected "sweet white" wines and those who frequently selected "full-bodied red" wines. These lower hedonic ratings for the red wines by the Asian consumers might be attributed to their lack of familiarity (Table 2), but possibly also due to their heightened sensitivity to bitterness, astringency [7] and alcohol [8,30].

Hedonic visual ratings for the wines did not differ significantly for the majority of consumers, between the first and twelfth week of wine education, as shown in Figure 2A,C,E, for NA, EU and Asian

consumers, respectively, with the exception of Chardonnay for the NA consumers. This suggested that hedonic aroma and flavor ratings were more readily affected by wine education.

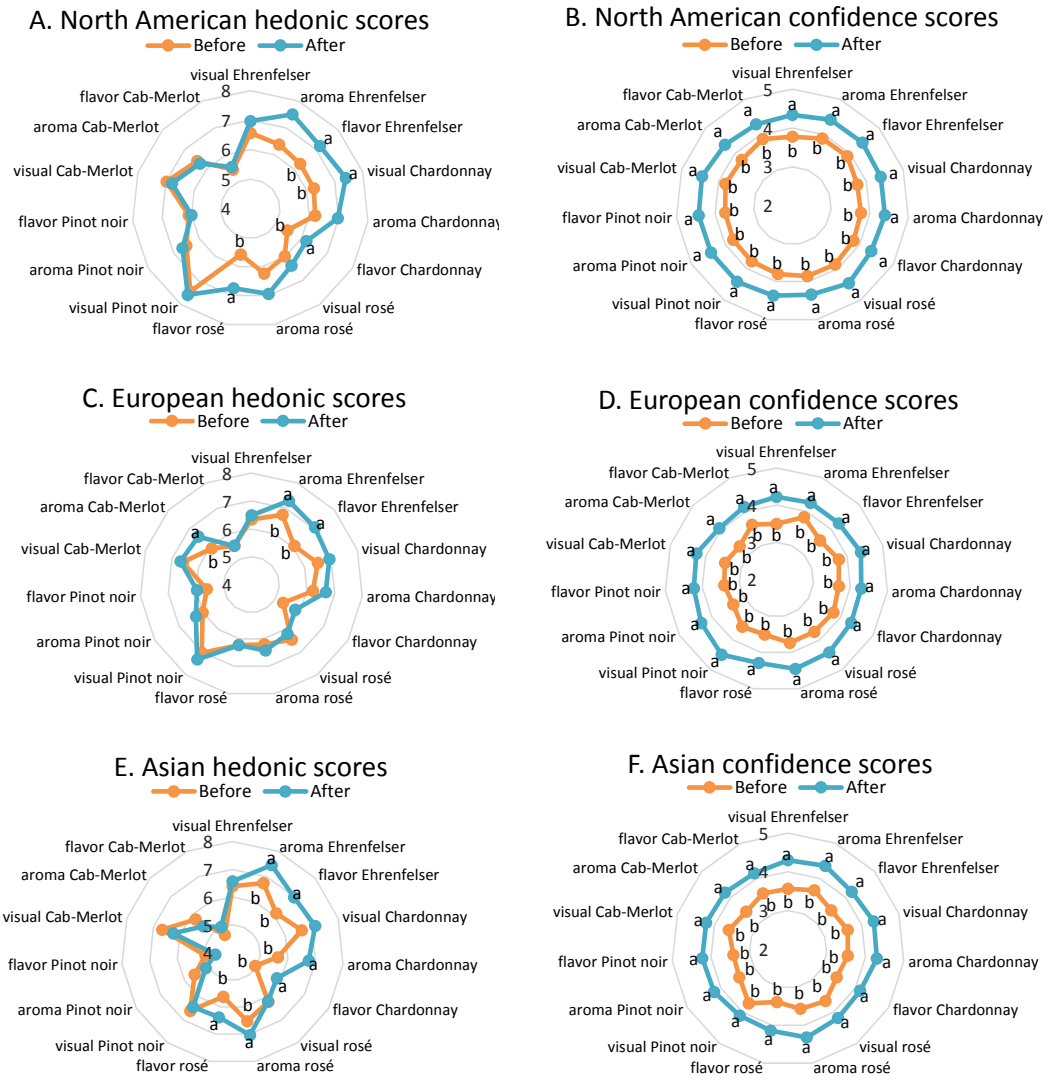

Figure 2. Mean hedonic ratings (degree-of-liking, max. = 9) and mean confidence ratings (degree-of-sureness, max. = 5) for North American (**A**,**B**), European (**C**,**D**) and Asian (**E**,**F**) consumers, before and after 12-weeks of wine education/training. Means identified with different superscripts (a,b) are different ($p \leq 0.05$) according to the Wilcoxon Signed Rank test. Tests were conducted on each wine characteristic (visual, aroma, flavor) for each of the five wines.

After wine education/training, the Asian consumers generally showed a greater number of significantly higher ratings for aroma and flavor for the white and rosé wines than did the NA consumers, who showed more than the Europe consumers.

Interestingly consumers did not change their hedonic aroma and flavor ratings for the red wines, after wine education/training, regardless of their ethnicity (Figure 2A,C,E), with the exception of the aroma ratings for Cabernet-Merlot for the EU consumers. The findings are consistent with the fact that consumers in this research were relatively young (early 20s) and had, on average, accumulated very limited experience in wine tasting, despite the fact that they had received 12-weeks of theoretical and practical wine training. However, these findings do support the work of Taylor et al. [31] who reported the preferences of a red wine (Cabernet Sauvignon), evaluated on a 5-point semantic scale from "like very little" to "like very much" (n = 78), were unchanged after an 8-h wine education

class, that consisted of four 2-h wine training sessions. Therefore the following question remains unanswered: "What is the duration and intensity of education/training necessary for the acquisition of red wine preferences?" Such a timeline is believed to be particularly relevant in the context of training and accrediting wine professionals such as sommeliers.

3.3. Sensory Ballots: Confidence Ratings

Consumers' confidence in their hedonic ratings increased significantly with wine education/training, for all wines and wine characteristics (visual, aroma, flavor) (Table 4). Responses were dependent on the ethnicity of consumers, as shown in Figure 2B,D,F for NA, EU and Asian consumers, respectively. On average, confidence increased slightly more for the Asian consumer ($\overline{x}_{before}$ = 3.5, $\overline{x}_{after}$ = 4.2) (Figure 2F) than the NA consumers ($\overline{x}_{before}$ = 3.8, $\overline{x}_{after}$ = 4.4) (Figure 2B), with an incremental change (Δ) of 0.7 and 0.6, respectively. For these consumers, the incremental change was similar for all wines and wine characteristics, as evident from the symmetry of the concentric circles in Figure 2B,F. In contrast, the incremental changes in confidence for the EU consumers were on average greater for the red wines (Δ = 0.8) rather than the white/rosé wines (Δ = 0.6), as evident from the asymmetry of the concentric circles in Figure 2D. Although little is known about the basis for such differences, an individuals' confidence is thought to be dependent on personality traits [32] and the task-at-hand [33]. The greater the familiarity with the task-at-hand the greater the consumers' certainty in the decision making process [33]. As such, this research is the first of its type to document an increase in consumers' confidence associated with their hedonic ratings as the result of wine education/training. This is in contrast to research in the literature that reports an increase in consumer confidence with wine education/training, as the result of an enhanced ability to understand labels and make informed purchase decisions [27].

3.4. Correlation between Prior Wine Knowledge with Hedonic/Confidence Ratings

In this research, Asian consumers had lower hedonic and confidence ratings for wine; however, they also self-professed to be less knowledgeable and to be less experienced with wine in comparison to their NA and EU counterparts (Table 2). Therefore, it was desirable to evaluate the role of prior wine knowledge on the hedonic and confidence ratings, using Spearman correlation coefficients.

Prior wine knowledge was positively correlated with confidence ratings (r_s = 0.17–0.36, n = 133) at $p \leq 0.05$ (detailed results not shown). This suggested that consumers, in general, were more confident about their wine preferences as their knowledge increased—even when their wine knowledge was "limited" to "moderate". As such, the results are consistent with findings of Barber et al. [34] who suggested that experience with a product builds confidence, regardless if the actual product knowledge is low.

Moreover, prior wine knowledge was positively correlated with the hedonic ratings, but only for red wines (Pinot noir, Cabernet-Merlot) (r_s = 0.19–0.35, n = 133) at $p \leq 0.05$ (detailed results not shown). This suggested that wine knowledge played a particularly important role in the appreciation of red wines—which are typically dry and may be more complex than white wines. Barber et al. [34] indicate that what consumers actually "know" about wine is more related to their wine experience, than their objective (learned) wine knowledge. Anecdotally, consumers who have acquired a preference for "big red wines" are more likely to be male and think of themselves as connoisseurs [19]—whether justifiable or not.

Johnson and Bastian [35] classified their 61 Australian consumers by their level of wine expertise, using a combination of a wine knowledge test and an aroma identification (sensory) test. They found that (i) female and male consumers at all levels of expertise were more likely to prefer white and red wines, respectively, and (ii) consumers with high levels of expertise were more likely to have higher wine purchase and consumption patterns.

4. Conclusions

This research surveyed millennial consumers of different ethnicities for their frequency-of-purchase, frequency-of-consumption and knowledge of wine. NA and EU consumers in this study had significantly higher frequency-of-purchase, frequency-of-consumption and knowledge of wine than Asian consumers; however, Asian consumers were willing to pay more for a bottle of wine.

The research quantified the influence of a 12-week university wine education course on consumers' hedonic and confidence ratings of five BC wines. It documented that hedonic aroma and flavor ratings increased for white (Ehrenfesler, Chardonnay) and rosé wines, but remained unchanged for red wines (Pinot Noir, Cabernet-Merlot), after a 12-week education/training course. In fact, consumers' pre-existing preferences were enhanced, and there was no evidence to suggest that consumers would shift their preference from one wine style to another (e.g., sweet white/rosé to dry red) over this period. However, it is speculated that wine preferences might have changed had the duration of the training been longer or if a follow-up assessment been conducted several months after completion of the course.

This work also demonstrated that consumers' prior wine knowledge was positively correlated with consumers' hedonic ratings for red wines, as well as with their confidence ratings for all wines. NA and Asian consumers with a greater level of wine knowledge purchased and consumed more wines; this relationship did not exist for EU consumers.

There were also differences in hedonic ratings and confidence levels, initially and at the end of the study, for consumers of different ethnicities. These ethnic differences are reflected in the marketplace, with Asian consumers generally having less wine knowledge and considerably different behavioral (consumption/purchase) patterns. Nevertheless, the training provided here would have cumulative benefits to the consumers' (positive) wine experience, thereby playing a role in the acquisition of their wine preferences. This work provided insight into millennial consumers and served as a stepping stone to more fully understanding the evolution of consumer preferences over time.

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Conflicts of Interest: The authors declare no conflict of interest.

Abbreviations

NA North America(n)
EU Europe(an)

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