Development and evaluation of an iPad application as an e-learning tool for technical wine assessment

ABSTRACT

Objective training in technical wine evaluation is a critical component of wine education and the ability to recognise, describe and communicate wine sensory attributes using formal descriptive language is a key learning outcome for winemaking and wine business students alike. Wine evaluation is taught and assessed during formal sensory practicals, however, a significant proportion of students' tasting experience occurs outside the classroom, and thus, is never evaluated. Furthermore, diversity in the backgrounds and life experiences of students studying wine-related courses also presents several unique learning and teaching challenges; with significant differences observed between domestic and international students' participation in and perceptions of wine sensory evaluation. This paper describes the development and evaluation of My Wine World, an iPad application designed specifically for technical wine assessment. The development process, together with an evaluation of the application's capacity to develop and demonstrate students' sensory skills and experiences, are reported.

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KEY WORDS

Introduction

Objective training in technical wine evaluation is a critical component of wine education, because wine appearance, aroma, flavour, taste and mouthfeel, i.e. the sensory attributes of wine, drive quality and consumer acceptability (Iland et al. 2009).

Technical wine evaluation therefore features prominently in wine education programs, including those at the University of Adelaide, where winemaking (i.e. viticulture/oenology) and wine business students alike, learn to objectively describe the sensory attributes of wine and differentiate wines on the basis of variety, style and quality.

Technical wine evaluation typically involves completion of tasting notes, to record detailed observations and perceptions of wine sensory attributes. Sensory skills are taught via wine tasting practical sessions, during which students develop their ability to recognise and describe wine sensory attributes using formal descriptive language. Students are then assessed based on the quality of their tasting notes; both the level of detail recorded and the range and appropriateness of descriptive language used. However, a significant proportion of students' tasting experience takes place outside the classroom, and thus, is not currently evaluated within the parameters of their formal education.

Technology is increasingly being utilised in learning and teaching. Examples of e-learning applications include social networks, discussion boards, wikis and virtual worlds; the use of which may be considered to facilitate student participation, critical thinking and reflection (Vallance 2008, Yang *et al.* 2008). The recent advent of tablet computers offers convenient, electronic platforms with which highly functional applications can be developed and used to facilitate flexible and adaptive approaches to learning and teaching (Manuguerra and Petocz, 2011). This includes mobile learning, defined by Traxler (2005) as 'any educational provision where the sole or dominant technologies are handheld or palmtop devices' (p. 262) and by Melhuish and Falloon (2010) as 'the ability to learn within one's own context when on the move in time and space' (p. 3).

This paper aims to describe (i) student participation in and perceptions of wine sensory evaluation and (ii) the development and evaluation of My Wine World, an iPad application for technical wine evaluation. My Wine World was designed to address University of Adelaide wine science academics' need for an educational tool that can both develop and demonstrate the sensory skills and experience of winemaking and wine business students. The capacity of the application to address learning and teaching issues arising from diversity in students' backgrounds and life experiences are also discussed.

STUDENT PARTICIPATION IN AND PERCEPTIONS OF WINE SENSORY EVALUATION.

There is significant diversity in the backgrounds and life experiences of students studying wine-related courses at the University of Adelaide, both at undergraduate and postgraduate levels. Undergraduate courses typically comprise a high proportion of school leavers, many of whom have very limited wine experience, but usually also comprise a number of mature age students, some of whom already work in the wine industry and therefore have considerable wine experience. Additionally, in recent years there has been a marked increase in the number of international students, particularly of Chinese origin, who are not always familiar with the 'western' terminologies used for describing wine sensory attributes, therefore cultural and linguistic-based challenges in interpretation may exist. To qualify this diversity, a survey was conducted to explore: student participation in wine sensory evaluation, both in and out of the classroom; the methods currently used by students to record tasting notes; student access to mobile devices and

computers (as justification for the development of an e-learning-based tool); and student perceptions of wine tasting practicals, including their willingness to participate in class discussions.

The survey, attached as Appendix I, comprised 5 sections. The first section captured demographic information, to allow responses given by different subsets of students to be analysed. Participants were asked to indicate whether they were studying viticulture/oenology or wine business, as domestic or international students, in undergraduate or postgraduate programs. Demographic questions also asked gender, year of birth, nationality, and duration and frequency of wine tasting/consumption. The second section asked students about where they taste/consume wine; for example, the proportion of their wine tasting that occurs during sensory practical classes at University, whilst working in bottle shops, or visiting cellar doors or wine festivals. Students then used 9-point Likert scales to indicate how often they would record tasting notes for each of these scenarios. The methods used by students to record tasting notes and their access to tablets, smartphones and computers were captured in section 4. In this section, students were also able to indicate the use of any mobile applications for recording wine tasting notes. Finally, students were asked to indicate to what extent they agreed or disagreed with a series of statements relating to wine sensory evaluation (again using 9-point Likert scales).

The survey was completed (voluntarily and anonymously) by 103 students (Table 1) who attended classes held during undergraduate and postgraduate courses (*Vineyard and Winery Operations A*, n=19, *Soils and Landscapes I*, n=18, *Sensory Studies II*, n=41 and *Advances in Wine Science III*, n=25) offered in Semester 2, 2013, within the University of Adelaide's viticulture/ oenology or wine business programs. The age of students surveyed ranged from 19 to 45 years, but the majority of students (84%) were aged in their 20s; with undergraduates being a few years younger on average, than postgraduates, as would be expected. There was approximately equal representation of female and male students, (45% and 55% respectively), albeit a greater proportion of undergraduate domestic students were female (79%) and undergraduate international students were male (76%). As such, the influence of gender on students' survey responses was not considered. Differences between study programs were also not considered, since of the students surveyed, the majority (84%) were from viticulture/oenology programs. Instead, differences between undergraduate and postgraduate cohorts and/or domestic and international cohorts were investigated (using analysis of variance). The domestic cohort were almost all Australian citizens (51/54, 94%); whereas the international cohort comprised 9 different nationalities, but most were Chinese nationals (37/49, 76%).

Apparent differences were observed between domestic and international students' wine tasting experience, in terms of both years of consumption (Table 1) and frequency of consumption (Figure 1). On average, domestic students had consumed wine for approximately twice as many years as international students. Almost 90% of domestic students indicated they taste wine two or more times per week. In contrast, only 50% of international students taste wine this frequently; with a considerable proportion, i.e. >20%, tasting wine just once per month. Like any skill, technical wine evaluation improves with practice, so the frequency of wine tasting has implications for the development of students' wine sensory performance.

Table 1: Demographics of students surveyed.

	All Students	Undergraduate Students		Postgraduate Students	
		Domestic	International	Domestic	International
No. of students	103	34	25	20	24
Gender (F/M)	47/56	7/27	19/6	10/10	11/13
Age (range, average)	19–45, 25	20–45, 25	19–30, 22	23–41, 29	21–35, 26
Years of wine consumption[a]	6.0 ± 0.4	7.3 ± 0.8	3.4 ± 0.6	9.1 ± 0.8	4.1 ± 0.4

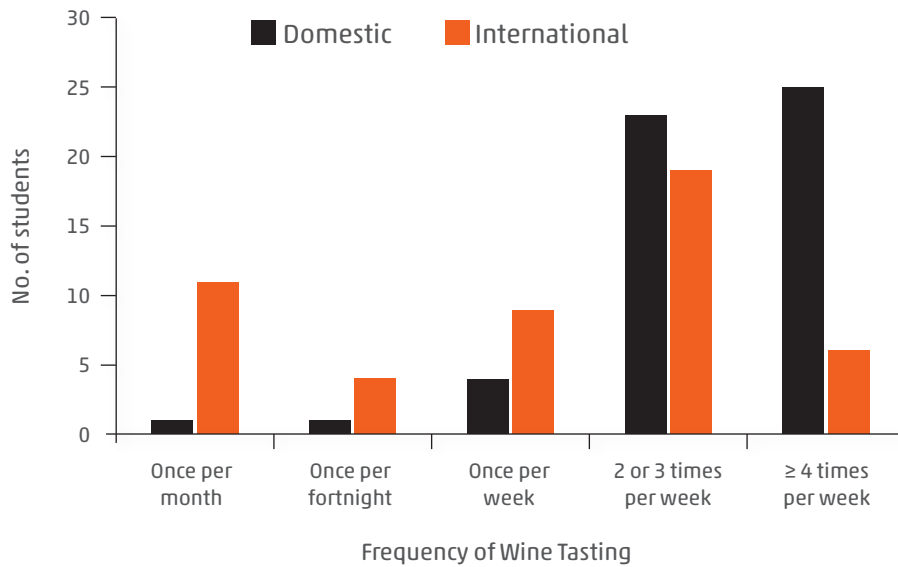[a]*Values are means ± standard error.*

Figure 1: Frequency of wine tasting by domestic and international students.

Table 2: Wine tasting by domestic and international students and likelihood of recording tasting notes.

	Domestic (n=54)	International (n=49)	P
Percentage of wine tasting occurring:			
At University	19.8 ± 2.6	43.6 ± 4.4	<0.001
At work	18.5 ± 2.7	4.7 ± 1.2	<0.001
At home	36.7 ± 2.9	31.3 ± 3.6	ns
At cellar doors or wine festivals	8.4 ± 1.3	6.7 ± 1.2	ns
At restaurants, cafes or wine bars	11.8 ± 1.3	8.5 ± 1.6	ns
At wine tastings	4.7 ± 0.8	4.9 ± 1.0	ns
Likelihood[a] of recording tasting notes:			
At University	8.3 ± 0.1	8.3 ± 0.2	ns
At work	3.8 ± 0.4	3.3 ± 0.7	ns
At home	2.3 ± 0.2	3.5 ± 0.3	ns
At cellar doors or wine festivals	3.3 ± 0.3	3.5 ± 0.4	ns
At restaurants, cafes or wine bars	1.8 ± 0.2	2.4 ± 0.3	ns
At wine tastings	3.3 ± 0.4	4.4 ± 0.4	ns

Values are means ± standard error; ns = not significant.
Mean comparisons were performed by least significant difference (LSD) multiple-comparison test at p < 0.05.
[a]9-point Likert scale responses, where 9 = always, 7 = usually, 5 = sometimes, 3 = occasionally and 1 = never.

Students' responses to the survey questions regarding where wine tasting occurs confirmed that a significant proportion of their tasting experience takes place outside the classroom, and again, significant differences were observed between domestic and international students (Table 2). Only 20% of domestic students' wine tasting occurs at University, with a considerable proportion of these students (37/54, 69%) indicating they partake in wine tasting in a work-related capacity, e.g. in a bottle shop, restaurant or cellar door, almost as regularly. In these roles, students are likely to engage in wine-related discussions with consumers, affording them opportunities to gain experience, and therefore confidence, describing and communicating wine sensory attributes using descriptive language. In contrast, University-based wine tasting accounted for a comparatively higher proportion (44%) of international students' wine tasting experience. Fewer international students (14/49, 29%) worked in roles that involved wine tasting, so work-related tasting was significantly lower than for domestic students. As a consequence, international students are less likely to have meaningful opportunities for evaluating and discussing the sensory attributes of wine, outside the classroom, which might negatively influence their willingness to participate in discussions during wine tasting practicals.

Domestic and international students indicated they also taste/consume wine at home, at cellar doors and wine festivals, whilst dining out and, to a lesser extent, at tastings held by bottle shops or wine clubs. However, no significant differences were observed in the percentages allocated to wine tasting at these scenarios by domestic and international students. Nor were significant differences observed for the likelihood of students recording tasting notes (Table 2). Domestic and international students alike indicated they almost always recorded tasting notes during University-based wine tastings, but elsewhere, tasting notes were only recorded occasionally, if at all. This supports the previously discussed suggestion that a significant proportion of students' wine tasting experience is never evaluated. Students are actively encouraged to taste wine outside the classroom environment, to enable them to gain exposure to a broader range of wines; i.e. wines made from different grape varieties, originating from different regions, using different production methods, of different style and quality. The above results clearly demonstrate student involvement in extra-curricular wine tasting. Such tasting would undoubtedly improve students' sensory skills and

experience, and is likely to be reflected in students' performance in both wine tasting practicals and the sensory examinations used for summative assessment. Academics nevertheless recognise a missed opportunity and have long sought a means by which to evaluate the development of students' sensory skills outside the classroom and throughout the duration of their studies.

Traditionally, wine industry professionals record tasting notes in a wine diary or journal, but these can be cumbersome, messy and easily lost or damaged. Additionally, they cannot be easily searched, for example to compare tasting notes for specific grape varieties, wine styles and/or regions, so they offer limited opportunities for assessing students' tasting experience. In the current study, students were asked how they typically recorded tasting notes and almost all students (99/103, 96%) made reference to a notebook, journal or diary. Only a small proportion of students (11%) indicated they currently use a tablet, smartphone or computer to record tasting notes, although some students (13%) indicated previous use of applications (from simple note-taking applications to wine-specific applications) for recording tasting notes. Student ownership of mobile devices and computers was investigated as part of the justification for developing a technology-based learning tool. All of the students surveyed owned some form of technology (Table 3), with laptops and smartphones being most ubiquitous. That most students (100/103, 97%) owned a tablet and/or smartphone is not surprising, given recent research estimated there were 8.67 million smartphone users and 4.37 million tablet users in Australia at May 2012 (ACMA 2013); but it was surprising that so few students made use of these devices to document their wine tasting experiences, especially outside of the classroom. It should be noted that in this study, the high proportion (92%) of undergraduate students with tablets can be attributed to an 'iPad enhanced learning' initiative implemented by the University's Faculty of Sciences, which involved iPads being issued to all first-year science students, including undergraduates enrolled in viticulture/oenology.

Table 3: Student ownership of tablets, smartphones and laptop and desktop computers.

	Tablet	Smartphone	Laptop	Desktop
All students (n=103)	79	94	96	21
Domestic students (n=54)	44	48	49	15
International students (n=49)	35	46	47	6
Undergraduate students (n=59)	54	55	54	13
Postgraduate students (n=44)	25	39	42	8

The final survey questions explored student participation in and perceptions of wine tasting practicals. Students with limited wine experience and/or limited wine vocabularies have a tendency to overuse broad descriptors (e.g. 'fruity' or 'oaky') and to avoid participation in class discussions during wine tasting practicals (based on the experience of wine science academics). This can impede the development of some students' wine vocabularies, and therefore, their ability to confidently describe and communicate wine sensory attributes using technical, descriptive language. Students were asked to respond to a series of statements relating to wine sensory evaluation to investigate their participation in and perceptions of wine tasting practicals (Table 4). Students unanimously agreed with the statement 'I enjoy wine sensory classes'; in agreement with student feedback obtained from University based evaluations of learning and teaching that demonstrate the popularity of sensory practicals (data not shown). However, divergent responses (i.e. responses ranging from between 1 or 2 and 9) were observed for all other statements. Analysis of variance indicated this was largely due to significant differences between responses from domestic and international students. Domestic students indicated they were generally more confident describing wine sensory attributes and sharing their tasting notes/opinions than international students; they also rated their wine vocabulary more highly. Whereas international students generally thought other students wrote more detailed tasting notes and used more descriptive language. With regards to participation in class discussions held during wine tasting practicals, domestic postgraduate students participated the most (6.9), and international undergraduate students the least (4.6). International students indicated a stronger preference for letting other students contribute to class discussions instead. However, the results also demonstrate that within any given cohort,

there is considerable diversity in student perceptions of wine sensory evaluation; i.e. a reasonable proportion of students find wine evaluation somewhat difficult and show concern for the quality of their tasting notes. Whilst student responses did not correlate with their demographics, it would still seem reasonable to expect younger and/or international students to have limited wine tasting experience. These students might therefore benefit from learning support that helped to familiarise them with the formal descriptive language used to describe wine appearance, aroma, flavour, taste and mouthfeel, in order to develop their wine vocabularies.

DEVELOPMENT OF AN IPAD APPLICATION FOR WINE SENSORY EVALUATION

My Wine World is an iPad application developed (at the University of Adelaide) in response to wine science academics' need for an educational tool that could be used to both develop and demonstrate the sensory skills and experience of winemaking and wine business students. Several mobile operating systems were considered as platforms for an e-learning tool for technical wine assessment, but the Apple operating system (iOS) was chosen to coincide with the University's iPad enhanced learning initiative. The development of My Wine World made use of action research (Ozanne and Saatcioglu 2008) as a methodological framework. As per the process of action research, this involved phases of design and development (action) followed by evaluation and reflection (research), to optimise the structure, content and functionality of My Wine World, as an e-learning tool for wine sensory evaluation. The first action research phase involved development of a prototype application. The prototype comprised a wine tasting tutorial that

Table 4: Student participation in and perceptions of wine sensory evaluation.

	Domestic (n=54)	International (n=49)	P
Percentage of wine tasting occurring:			
I enjoy wine sensory classes	7.9 ± 0.2	8.1 ± 0.2	ns
I find it difficult to evaluation the sensory attributes of wine	4.2	4.8 ± 0.3	ns
I am confident describing wine sensory attributes in detail	5.9 ± 0.2	5.2 ± 0.2	<0.05
I think other students write more detailed tasting notes than I do	5.5 ± 0.3	6.4 ± 0.3	<0.05
I think my wine vocabulary is good	6.0 ± 0.2	4.5 ± 0.2	<0.001
I often describe wine as 'fruity' or 'oaky'	4.2 ± 0.3	5.1 ± 0.3	<0.1
I think other students use more descriptive language than me	5.4 ± 0.3	6.4 ± 0.3	<0.05
I often participate in discussions during sensory classes	6.2 ± 0.2	4.8 ± 0.3	<0.001
I am confident sharing my tasting notes/opinions during sensory classes	6.1 ± 0.3	5.1 ± 0.3	<0.05
I worry that my tasting notes/opinions are wrong or not good enough	5.0 ± 0.3	5.3 ± 0.3	ns
I prefer to let other students share their tasting notes/opinions	5.3 ± 0.3	6.6 ± 0.3	<0.001

Values are means ± standard error; 9 = strongly agree and 1 = strongly disagree; ns = not significant.
Mean comparisons were performed by least significant difference (LSD) multiple-comparison test at p < 0.05.

aimed to guide students through wine assessment, in a manner consistent with the approach used in sensory classes. A glossary of sensory descriptors was also incorporated to support and encourage student use of a broader range of descriptive language. The prototype incorporated touch tools such as colour displays, sliders and input screens to capture wine specifications, including vintage, producer, variety, region of origin and price, as well as student evaluations of wine sensory attributes, such as colour, aroma, flavour, taste and mouthfeel. These features facilitate the compilation of tasting notes in a format that can be easily searched and downloaded, providing an archive of each student's tasting experiences. As such, the application is expected to become an increasingly valuable learning resource as students progress through their studies.

In the second phase of participatory action research, the prototype was evaluated by the University of Adelaide's Wine Science academic unit. Participants included academics (n=4) and students (n=6) with formal training and/or experience in wine evaluation, as well as research staff and students without wine sensory training, who were therefore considered to represent wine consumers (n=8). This enabled the prototype to be evaluated by a range of individuals who might have an interest in its use. Participants were provided with an iPad and asked to record tasting notes for up to three wines using the My Wine World prototype. During the evaluation, participants were asked to make note of any technical issues they encountered (e.g. spelling mistakes). Participants also rated the suitability of My Wine World as an e-learning tool for wine sensory evaluation, as well as a range of additional application features.

The evaluations obtained for My Wine World were generally favourable, as evidenced by responses which ranged from 6.4 to 8.2, and an average score of 7.4, on the 9-point Likert scale (Table 5). Consumers typically gave the application and its features higher ratings than those given by students, who in turn gave higher ratings than academics; with the exception of the 'star-rating feature', which academics rated more favourably than both consumers and students. Each of the suggested additional features, including but not limited to, wine cellar management, educational content and the ability to share tasting notes via social media, were

also given favourable ratings of between 6.9 and 8.0 out of 9 (data not shown).

Perhaps of most importance for the development and academic team, was the support for My Wine World being used as an e-learning tool for technical wine assessment. This was evidenced through the following comments made by wine science academics and students (n=8) in response to the question: Do you think My Wine World would be a useful tool for learning/teaching wine sensory evaluation? *'Yes, examples of descriptors were useful'*; *'Yes, having descriptors in front of you always helps'*; *'Definitely, easier to keep track of tasting notes – no more scraps of paper'*; *'Yes, with some expansion and clarification'*; *'Yes, but may need some background instructions for new tasters'*; *'Could be good for advanced wine study and general tasting, well organised'*; *'Definitely, good database of terms - helps you choose appropriate attribute'*; and *'Yes, it would be good for tastings away from the uni also'*. No negative responses or comments were received for this question.

The final action research phase involved incorporation of feedback obtained during the prototype evaluation to refine the structure and content of My Wine World, prior to its release on the App Store. In 2014, *Foundations of Wine Science* students will be asked to use My Wine World to record tasting notes, both in and out of the classroom. The quality of students' tasting notes will then be assessed at regular intervals throughout the year, enabling academics to provide feedback on the level of detail and the range of descriptive language used by students to describe wine. In this way, My Wine World will be used as an evidence-based approach to learning and teaching (Bruniges 2008), to provide a more detailed overview of students' progression as wine sensory evaluators. The extent to which My Wine World can develop and demonstrate students' sensory skills and experiences will be the focus of future research; with the application's impact on student learning to be determined by evaluating its capacity to improve students' wine vocabularies and willingness to participate in class discussions, for example.

CONCLUDING REMARKS

The use of mobile devices for learning/training purposes in corporate and educational settings has previously been demonstrated (Traxler 2005 and citations therein). My Wine World offers many of the affordances recommended of mobile technologies for educational purposes, including portability, ubiquitous access, situated learning opportunities and personalised experiences (Melhuish and Falloon, 2010). It is hoped that the use of the My Wine World application as an e-learning tool for technical wine evaluation will address some of the learning and teaching challenges currently experienced in wine education, thereby enhancing student learning experiences and outcomes.

Table 5: Evaluation of My Wine World.

	All n=18	Academics n=4	Students n=6	Consumers n=8
What's your overall impression of My Wine World?	7.4 ± 0.2	7.1 ± 0.4	7.3 ± 0.3	7.6 ± 0.3
How would you rate the searchable database?	7.8 ± 0.2	7.4 ± 0.2	7.9 ± 0.3	8.1 ± 0.3
How would you rate the glossary of wine descriptors?	6.9 ± 0.3	6.4 ± 0.6	6.8 ± 0.3	7.3 ± 0.7
How would you rate the ability to give a star-rating?	7.1 ± 0.5	8.0 ± 0.7	6.6 ± 0.8	7.0 ± 0.8
How would you rate the ability to export tasting notes?	8.1 ± 0.2	7.8 ± 1.0	8.1 ± 0.3	8.2 ± 0.2

Values are means ± standard error; 9 = like extremely and 1 = dislike extremely.

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APPENDIX 1: STUDENT SURVEY - WINE SENSORY EXPERIENCE

GENERAL

Study program	❏ Viticulture/Oenology ❏ Wine Marketing/Business ❏ Undergraduate ❏ Postgraduate ❏ Domestic Student ❏ International Student		
Gender	❏ Male ❏ Female	Year of birth		Nationality	
For how many years have you been tasting/consuming wine?			
How often do you usually taste/consume wine?	❏ Once per month ❏ Once per fortnight ❏ Once per week ❏ 2 or 3 times per week ❏ ≥ 4 times per week		

WINE TASTING

Consider your wine tasting/consumption experience.
Estimate what percentage of your total wine tasting/consumption (must total 100%) occurs:

At University (e.g. during sensory practicals/in the winery)	%
At work (e.g. in a bottle shop/restaurant/cellar door)	%
At home	%
At cellar doors or wine festivals	%
At restaurants or cafes or wine bar**s**	%
At wine tastings (e.g. in a bottle shop or wine club)	%
Other, please specify:	%

RECORDING OF TASTING NOTES

Consider your wine tasting/consumption experience. How often do you record tasting notes, when tasting/consuming wine	Never		Occasionally		Sometimes		Usually		Always	Not Applicable
At University (e.g. during sensory practicals/in the winery)	1	2	3	4	5	6	7	8	9	NA
At work (e.g. in a bottle shop/restaurant/cellar door)	1	2	3	4	5	6	7	8	9	NA
At home	1	2	3	4	5	6	7	8	9	NA
At cellar doors or wine festivals	1	2	3	4	5	6	7	8	9	NA
At restaurants or cafes or wine bar**s**	1	2	3	4	5	6	7	8	9	NA
At wine tastings (e.g. in a bottle shop or wine club)	1	2	3	4	5	6	7	8	9	NA
Other, please specify:	1	2	3	4	5	6	7	8	9	NA

How do you record your tasting notes? List any/all methods (e.g. diary/journal/notebook).

Which of the following do you own?	❏ Tablet (e.g. iPad) ❏ Smartphone (e.g. iPhone) ❏ Laptop computer ❏ Desktop computer

Do you currently use, or have you previously used, any Apps for recording wine tasting notes? If so, which ones?

PARTICIPATION IN SENSORY CLASSES

Consider the following statements and indicate to what extent you agree or disagree with each.	Strongly disagree								Strongly agree
I enjoy wine sensory classes	1	2	3	4	5	6	7	8	9
I find it difficult to evaluate the sensory attributes of wine	1	2	3	4	5	6	7	8	9
I am confident describing wine sensory attributes in detail	1	2	3	4	5	6	7	8	9
I think other students write more detailed tasting notes than I do	1	2	3	4	5	6	7	8	9
I think my wine vocabulary is good	1	2	3	4	5	6	7	8	9
I often describe wines as 'fruity' or 'oaky'	1	2	3	4	5	6	7	8	9
I think other students use more descriptive language than me	1	2	3	4	5	6	7	8	9
I often participate in discussions during sensory classes	1	2	3	4	5	6	7	8	9
I am confident sharing my tasting notes/opinions during sensory classes	1	2	3	4	5	6	7	8	9
I worry that my tasting notes/opinions are wrong or not good enough	1	2	3	4	5	6	7	8	9
I prefer to let other students share their tasting notes/opinions	1	2	3	4	5	6	7	8	9