Does wine tasting education improve performance in qualitative assessment of spirits?

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Contents

1. Summary

There is a large body of evidence showing that skills learnt in one discipline can directly improve skills in another. This study investigated whether and, if so, to what degree, teaching participants to taste wine improves their ability to qualitatively assess spirits. Specifically, it focussed on the improvement in qualitative assessment of both wine and spirits in participants before and after they complete the Wine & Spirit Education Trust (WSET) Level 2 Award in Wines.

25 participants were asked to complete a quality assessment test for four wines (two white, two red, of different quality levels) and four spirits (two clear, two brown, also of different quality levels) one hour before and one hour after they attended a WSET Level 2 Award in Wines course, which covers wine, not spirits, within the syllabus.

It was found that completing the WSET Level 2 Award in Wines did improve students' performance on a quality assessment test of wine by 96% (P=.00001), and of spirits by 61% (P=.00001). The improvement in quality assessment of wines was of 35% greater magnitude (P=*.05)*. This provides support for skill transfer in the field of wine and spirits tasting, implying benefits for students of wine beyond their immediate field of study as well as indicating potential for tutors to streamline skill acquisition in their teaching.

2. Introduction

This study aimed to investigate the effect of wine training on qualitative assessment of spirits. In short: does training someone to taste wines make them better at tasting spirits?

Training a person in one specific field has been observed for over a century to improve performance in other fields across many different disciplines including (but not limited to) language, motor skills and a range of mental abilities[1] (Woodworth, 1901a). This effect is commonly referred to as 'skill transfer'. Wine and spirits tasting calls on all these physical and mental abilities, and more, therefore it could reasonably be expected that these disciplines may also display the skill transfer effect.

In teaching novices to taste wine and spirits, educators typically introduce a systematic approach to enable the student to focus on individual elements of each wine and spirit, before building those elements back into a whole (WSET, 2009). This study investigated whether learning a 'tasting system' within one specific category (wine), improves students' performance in qualitative assessment of samples from another drinks category (spirits); the purpose being to explore the wider benefits of wine education, benefits which may improve abilities beyond the primary topic of focus. In particular, if training in wine tasting could be demonstrated to improve abilities in other fields then it would provide a student greater reason to

[1] Mental abilities which have demonstrated skill transfer include, but are not limited to: vocabulary, memory and musical ability (Piro and Ortiz, 2009), spatial–temporal reasoning (Rauscher, 1997) attention, observation and discrimination (Woodworth, 1901b)

study, arm educators with greater knowledge of the impact of their teaching, and could facilitate more efficient ‘cross-training’ between different drinks categories.

The specific research questions addressed were:

1. To what extent are students who have completed the Wine & Spirit Education Trust (WSET) Level 2 Award in Wines significantly better at assessing the quality of wine than those who have yet to attend the course?

2. To what extent are students who have completed the WSET Level 2 Award in Wines significantly better at assessing the quality of spirits than those who have yet to attend the course?

3. Are any changes in these two dependent variables of similar magnitude?

3. Background and Context

3.1 Defining Quality

Before people's ability to assess quality in wines and spirits can be examined, what is meant by 'quality' in both categories must first be established.

Wine and spirits have, over the centuries, been defined and described in a vast number of ways (Shapin, 2012). In the scope of wine and spirit education, one objective is to enable the student to move beyond appreciation of subjective preference (e.g. liking vs not-liking) towards a more objective assessment of quality (e.g. good vs outstanding) (WSET, 2009), to enable clearer and more consistent communication between professionals and other interested parties. This is not an immediately intuitive approach to the novice, since "*it patently is not clear that we all have the same subjective experience when we taste a wine*" (Solomon, 1990, p1). In order to facilitate a more objective process, a range of systems have developed across the world which enjoy some considerable degree of overlap.

The Wine & Spirit Education Trust (WSET) is the global industry leader in developing and delivering wine and spirits education courses (WSET, 2020). They have developed a Systematic Approach to Tasting (SAT – see Appendix 1) for each of their courses, which provides a framework for tasters to aid them in writing comprehensive, well-ordered tasting notes. It concludes with an assessment of quality, expressed as one of six levels: Faulty, Poor, Acceptable, Good, Very Good, Outstanding.

Within WSET's wine courses, students are taught to place samples along this continuum by assessing various attributes of the wine, namely:

Balance: the degree to which the components of the wine complement each other, no single part diminishing the others; well-integrated alcohol, sweetness balancing with acidity. Better balance is aligned with greater quality.

Length: how long the desirable flavours of the wine persist on the palate. It is generally considered that higher quality wines have a longer finish.

Intensity: both the amount and definition of the flavour, sometimes thought of as ‘concentration’, both of which are considered markers of high-quality wines.

Complexity: broad ranging rather than singular flavour, where greater complexity tends to occur in higher quality wine. Complexity can come from the fruit alone (primary characteristics), from winemaking practices such as malolactic fermentation (secondary) or from lengthy maturation (tertiary) – or a combination of these factors.

These first four terms combined are often shortened to the acronym ‘BLIC’.

Overall Quality operates effectively as a summary of the previous four judgements.

Notably, these metrics are not directly measurable, objective features of a wine (in the same way as, say, the level of alcohol, sugar, or acidity would be). They are also different from a very basic subjective assessment of a wine (e.g. “I like this wine”) and duly have become part of the international language of wine and spirits quality assessment (Robinson, 2015).

These terms are also recognised by the Court of Master Sommeliers (Larsen-Robert, 2020, pers. comm.), upholders of the world’s highest standards of wine service (CMS, 2020), and Institute of Masters of Wine (IMW), who lay claim to the most respected title in the world of wine (IMW, 2020), when making qualitative judgements

about wine (Stubbs, 2020, pers. comm.). It should be noted, however, that both of these expert-level organisations demand far greater analysis of wines, drawing on further details not covered in these terms.

Spirits are, by their nature, very different liquids from wines (WSET, 2009). That notwithstanding, very similar indices of quality are utilised by the WSET (Appendix 1) when assessing both wines and spirits. There is a different flavour vocabulary since there are flavours specific to the wine category (e.g. tomato leaf, asparagus, wet stone) and the spirit category (e.g. barley, coriander, peat) but there is also a high degree of co-occurrence (mostly in fruits and flavours associated with maturity) and very similar principles of qualitative assessment are utilised: Balance, Length and Intensity, Complexity, Expressiveness and Overall Quality[2]. With an established scale of quality in place, it is possible to assess people's ability to determine quality.

Assessment of quality is not the sole aim of any of these awarding bodies, nor would it be possible to teach people how to do this without looking first at other elements of wine and spirits. Each body champions its own system – many variants of which exist – for example the Court of Master Sommeliers 'Grid' (CMS, 2020), and the WSET Systematic Approach to Tasting (Appendix 1), all of which are designed to enable the student both to experience and to communicate the specific attributes of each wine / spirit they sample; from appearance to nose, palate to finish, before arriving at their conclusion. The word 'experience' is used intentionally here, since

[2] The factors in the spirits SAT are slightly different from wine – Balance, Length *and* Intensity, Complexity, and Expressiveness (at Level 3). Expressiveness is the extent to which the spirit's flavours and/or texture express its raw materials or the way it has been made. In this, precision and clarity are features – so it aligns very similarly to the 'definition' within Intensity. Although the precise wording is slightly different, the same basic features are being considered.

there is mounting evidence to suggest that vocabulary is not simply a product of our experience but rather something which directly informs our experience (Olofsson, 2015). For example, it has been demonstrated that teaching students about tannin in wine not only changes their ability to assess it, but also increases their 'hedonic appreciation' (enjoyment) of wine (Drew, 2018). Simply put: *"Language affects perception, as well as being a tool to describe that perception"* (Goode, 2016, p168). It is feasible, therefore, that the experience of learning to taste in one discipline will develop an increased tasting vocabulary which, in turn, would positively affect one's perception and appreciation of complexity in another. Furthermore, concepts such as Balance and Length in wine can be directly applied to tasting in other categories, including spirits.

3.2 Skill Transfer

Wine (and spirits) tasting calls upon numerous cognitive faculties. It has been postulated that the tasting of wine *"engages more of the brain than any other human experience"* (Shepherd, 2017, p2) – language, motor skill, imagination, visualisation, and recall to name but a few.

For over a century, psychologists have demonstrated skill transfer in functions involving attention, observation and discrimination (Woodworth, 1901b). In linguistics, the early stages of third language acquisition (TLA) have been shown to progress faster than second language acquisition (SLA) (Herdina, 2000), which indicates that having learned a second language makes it (relatively) easier to then learn a third. However, the later stages of language expertise – fluency – can

actually be confounded in TLA by an interference effect described as ‘competitive resource’, whereby the limited resources of attention and memory are divided by a greater number of cognitive demands (Selinker and Baumgartner-Cohen, 1995). This presents the possibility that whilst having learned a second language may accelerate the early stages of acquisition of a third, it may in fact be the case that skill transfer actually inhibits expertise at a higher level.

Learning to play a musical instrument has also been found to benefit from skill transfer. Learning to play one instrument facilitates faster skill acquisition of another (Lee, 2007). This is perhaps not surprising, since elementary musical skills (reading music, keeping time etc.) are directly transferable. Less predictably, learning a musical instrument has also been shown to improve vocabulary in children (Piro, 2009), improve verbal memory (Chan, 1998) and improve spatial–temporal reasoning (Rauscher, 1997) – all of which demonstrate positive benefits of skill transfer in a multi-disciplinary context.

Motor skills are also important in wine and spirits tasting - the fluid dynamics of moving wine or spirits around both the glass (Strain, 2011) and the mouth (Shepherd, 2017) having a profound impact on our appreciation of them. Manipulating a wine / spirit in the mouth in order to access the full palate and retro-nasal appreciation is a skill which takes some development, and there is a significant body of research supporting positive effects within the transfer of motor skills (Schmidt, 1987). It seems reasonable, therefore, that a task which calls upon a range of cognitive and physical skills should also benefit from skill transfer. There is strong anecdotal evidence for this:

- Victoria Burt MW noted that when approaching spirits tasting in a structured manner for the first time her experience as a Master of Wine helped her move quickly into a systematic appraisal of quality (Burt, 2020, pers. comm.).
- Barbara Drew MW benefitted from her wine expertise when approaching a professional qualification in cheese, stating that the practice of analysing taste and texture systematically was already habitual due to her wine training, making it easier for her to apply the same system to qualitative appraisal of cheeses (Drew, 2020, pers. comm.).
- Christine Marsiglio MW found the same when entering a new sphere of the beverage industry. She sat the WSET Level 3 Award in Sake and reports finding transitioning from wine to sake tasting easier than ‘learning to taste’ the first time around (Marsiglio, 2020, pers comm).

Wine (and spirits) tasting is indeed a skill that calls upon both motor and cognitive skills, many of which have been shown to benefit from skill transfer (Schmidt, 1987). It is therefore postulated that improvement in qualitative assessment of wine should improve ability to qualitatively assess spirits.

3.3 Developing Expertise

At the time of writing, only 269 people have attained the title Master Sommelier (MS) and there are currently 394 Masters of Wine (MWs). These people can rightly be referred to as experts in their field, but how do experts in wine differ from novices? A commonly held view is that experts have ‘more’ of an attribute which novices lack (Latour, 2018); be that vocabulary (West, 1996), experience (Shepherd, 2012) or innate ability (Raven, 2005). Progression from novice to expert wine / spirits taster takes time, not least because there are so many facets to the skill that need to be applied simultaneously, including (but not limited to): language, memory, motor and sensory skills (Goode, 2016).

It is notable that the development from novice to expert is non-linear and it is an observable phenomenon that development proceeds in several ‘stage-gated’ phases. That is to say, moving to the mid-ground between novice and expert, termed ‘enthusiast’, requires different learnings and mechanisms than the onward progression from enthusiast to expert (Latour, 2018).

Progression from novice to enthusiast level benefits significantly from the introduction of framework and structure (such as the BLIC approach to quality). Conversely, development from enthusiast to expert benefits more from *removal* of the restrictions that such a system can impose (Latour, 2018). Hence, as noted by the Education Committee Panel Chair for the IMW, Matthew Stubbs MW, *“BLIC will only get you half-way there, at most. At the Master of Wine level BLIC is such an instinctive approach that you become free to explore what is really relevant within the glass”* (Stubbs, 2020, pers. comm).

Development from enthusiast to expert relies more on factors gleaned from experience, as opposed to the introduction of new systems (Pazart, 2014). One's tasting vocabulary develops with a symbiotic relationship to both tasting ability as well as enjoyment of wines: by experiencing new flavours and textures one enriches their taste memory and vocabulary and, when learning new vocabulary, one increases their ability to experience these new flavours. Both go on to increase one's preference to the wine (Spence, 2017).

This has particular relevance when considering the relatively 'niche' positioning of those wines generally considered higher quality (and often of higher monetary value) when compared to more high-volume lower-priced wines: 'crowd-pleasers'[3] tend to be simpler styles of wine and do indeed please a crowd since they can be enjoyed freely by consumers with little or no training in tasting. The complexity of flavours in more esoteric wines and spirits is not only likely to go unnoticed by the novice consumer, but can on occasion be actively off-putting (Goode, 2014).

This research is the first study on skill transfer within the field of tasting. As such, the population and skill chosen for study were those considered most likely to demonstrate transfer. It was anticipated that the skill transfer benefit of wine training would have the greatest effect in novices, where the implementation of structure and analytical process provide the framework for accurate analysis. Therefore, the research specifically investigated the improvement in quality assessment of wines and spirits in participants at *novice* level.

[3] 'Crowd pleasers' are regarded as wines which are generally fruit-forward, well rounded with low tannin, as well as being considered good 'value for money' (Puckette, 2019).

Furthermore, it was expected that the greatest skill transfer effect would be seen in the abstract concepts seen within quality assessments rather than flavour descriptors or tasting metrics (such as acidity, sugar or alcohol): whilst one might reasonably expect the newly learnt wine aroma lexicon could be applied to spirits, there are clusters of aromas which are unique to each of these two fields, and the tasting metrics reflective of physical attributes require practice and experience. It was also expected that the magnitude of improvement in the scores on quality assessment of wine would be greater than the improvement in quality assessment of spirits (since spirits are not tasted during the course of the L2). Changes in performance before (pre-condition group) and after (post-condition group) on a quality assessment test were therefore measured in both wines and spirits, allowing comparison between the two.

4. Methodology

The literature review, which formed the background and context of this paper, informed the following research questions:

1. To what extent are students who have completed the Wine & Spirits Education Trust (WSET) Level 2 Award in Wines significantly better at assessing the quality of wine than those who have yet to attend the course?

2. To what extent are students who have completed the WSET Level 2 Award in Wines significantly better at assessing the quality of spirits than those who have yet to attend the course?

3. Are any changes in these two dependent variables of similar magnitude?

In order to answer these questions, three hypotheses were developed (detailed below). Non-directional hypotheses were chosen to allow for the possibility that the mean post-condition group scores could, theoretically, be lower than the mean pre-condition group scores.

4.1 Hypotheses

Hypothesis 1: Mean scores in a quality assessment test of wines are significantly different for participants who have completed the WSET Level 2 Award in Wines compared to those who have yet to attend the course.

[Null Hypothesis 1: Mean scores in a quality assessment test of wines are not significantly different for participants who have completed the WSET Level 2 Award in Wines compared to those who have yet to attend the course.]

Hypothesis 2: Mean scores in a quality assessment test of spirits are significantly different for participants who have completed the WSET Level 2 Award in Wines compared to those who have yet to attend the course.

[Null Hypothesis 2: Mean scores in a quality assessment test of spirits are not significantly different for participants who have completed the WSET Level 2 Award in Wines compared to those who have yet to attend the course.]

Hypothesis 3: Any changes in these two dependent variables will not be of similar magnitude.

[Null Hypothesis 3: Any changes in these two dependent variables will be of similar magnitude.]

4.2 Participants

This investigation required participants, novices in both wine and spirits, to sit two qualitative tasting tests of both wines and spirits: one an hour before and the other an hour after they attended the WSET Level 2 Award in Wines course (henceforth 'L2'). Both tests were identical.

There were 25 participants recruited, voluntarily, from a pool of students studying L2 at the WSET School, London. All students that were starting a L2 course in the months of January-March 2020 were contacted by email by the school's Level 2 Programme Manager (118 students in total). Of 32 respondents, four were excluded due to having previous training in spirits and three failed to attend. A prize of a mixed case of wine and spirits was offered as an incentive to participate. The study was described to participants as an MW Research Paper investigating people's assessment of wines and spirits before and after their WSET L2 Award in Wines. No further information was provided, preventing participants from being able to influence the outcome of their results.

The L2 is a beginner- to intermediate-level qualification exploring wines, suitable for industry professionals and wine enthusiasts (WSET, 2020). Within the course, students are taught to make objective assessments of the quality of wines. Assessment is a 50-question multiple choice examination of theory knowledge only (no tasting element). L2 students were specifically chosen since there are no entry criteria for the course, and it contains no reference to spirits. This is a recent change: until 2019, spirits were covered (albeit briefly) in the L2 course, meaning that L3

students – who are likely to have studied spirits on the previous version of L2 – could not be considered spirits novices.

A questionnaire prior to the tests allowed participants with previous spirits training to be removed from the sample (see Appendix 2).

4.3 Experimental Design

A within-subjects design was used, with all participants asked to complete a quality assessment test one hour before and one hour after the L2. The quality assessment test (QAT) involved the assessment of both wines and spirits and was specifically designed for this research (see Appendix 2).

The test comprised eight samples: two white wines, two reds wines, two clear spirits and two brown spirits.

Sample 1. *Chardonnay Domaine de Pennautier, Pays d'Oc 2018*

Sample 2. *Château de Meursault, Meursault Clos des Grands Charrons 2015*

Sample 3. *Viña Zorzal Garnacha, Navarra 2018*

Sample 4. *Contino Graciano, Rioja Reserva 2012*

Sample 5. *Elephant Dry Gin, 45% ABV*

Sample 6. *Hoxton Grapefruit & Coconut Gin 40% ABV*

Sample 7. *Sailor Jerry Rum 40% ABV*

Sample 8. *Pussers 15 Year Old Rum 40% ABV*

These samples were chosen to display different levels of quality in each pair: one more basic 'good' example[4] (well made, free from faults and commercially successful – Samples 1, 3, 6 & 7) and one higher quality 'outstanding' example (with increased balance, length, intensity, complexity and overall quality – Samples 2, 4, 5 & 8).

The wines pairs were chosen due to their similarity in primary characteristics (citrus and stone fruit in the whites, ripe black fruit in the reds) and vastly differing levels of intensity, length, complexity and overall quality.

For clear spirits, gin was chosen as the category most able to show a distinct variance in quality, due to its increased ability to show greater balance, length, intensity, complexity and (therefore) overall quality against other unaged spirits such as vodka. Whilst other spirit categories may claim the same distinction (tequila, rum etc.), gin is more likely to be within the familiarity of a UK-based sample, thereby avoiding 'novelty value' as a confounding variable (Förster, 2011).

For calibration purposes, the samples were first presented to four wine experts (Samples 1-4) and four spirits experts (Samples 5-8). All experts held the Master of Wine qualification, were Master Distillers and / or had acted as judges on international tasting panels for a minimum of five years. Their responses provided the marking criteria for the test.

Participants were presented with eight numbered glasses (S1-S8) with samples poured blind. They were also provided with the quality assessment test (QAT -

[4] One of the basic samples (6) was actually rated as 'Acceptable' by the expert panel (the others 'Good'), but for descriptive ease the lesser quality sample group will be termed 'Good' and the higher quality sample group 'Outstanding' henceforth.

Appendix 2) and clear instructions, both written and orally. There was no time limit for the test.

The QAT was administered immediately (one hour) prior to the participants commencing their L2 (pre-condition group), and again immediately after their course was complete (post-condition group[5]), in a tasting room with good natural light and no distracting odours or noise to provide consistency across the two conditions. These conditions are essential controls for the tasting environment due to the cross-modal nature of flavour perception: appearance of wines and spirits strongly influences how we experience the taste (Parr, 2003), most famously demonstrated by 'The Brochet Experiment'[6].

Cross-modal influence on tasting is not only affected by visual presentation. Smells, too, play an important role primarily due to a phenomenon known as 'desensitization and cross-adaptation'. Explained simply, desensitization informs us that if a smell is present in a room then it is usually noticed by a person upon entering the room, but one quickly adapts to its presence. This makes it less likely that those aromas would be noticed if also present in the wine or spirit (Goode, 2016). In cross-adaption, the presence of one aroma changes the perception of another, which makes order of

[5] These two 'groups' (pre-condition and post-condition) were intended to be the same groups of people. However, due to some drop-outs (from the post-condition) they are termed as different groups for both descriptive and analytical purposes. When only the results from the same individuals are compared (before and after tuition) it is made clear in the text.

[6] The Brochet Experiment: experts were asked to describe the aroma of one white wine and one red wine. Several days later they were presented with the same two wines, but the white wine has been altered with an odour-neutral red food colouring; the aromatic characteristics reported by the experts in the 'white' wine altered significantly in the second condition) (Gottfried, 2003). Further investigation into this phenomenon has consistently demonstrated large shifts in perception when the same foods and drinks are presented with their appearance altered (Beeli, 2005).

tasting important (Goode, 2016)[7]. With this in mind, participants were asked to taste in the same order, from one to eight, in both the pre- and post-condition groups, so that order of tasting did not introduce a further variable.

Sound, too, influences flavour perception. High frequency noises in the tasting environment have been repeatedly demonstrated to increase perceived sweetness in wine, whilst low frequently sounds enhance perceived bitterness (Spence, 2014). As such, the same tasting room within the same building, under exam (silent) conditions was used for every quality assessment test.

Glassware has also been demonstrated to influence perception of wines (Burt, 2015), with size, shape and weight all playing a part in how one perceives the drink contained within it, so standard ISO tasting glasses were used for every sample, in both conditions. Samples were served at room temperature, both to avoid the possibility of temperature affecting the flavours (and, hence, perceived balance thereof) and to emulate the tasting conditions of the L2 where all samples are tasted thus.

No performance feedback was given to participants in order to minimize any unintentional training benefit from re-testing (McAuliffe, 1974), nor were any of the samples revealed (in order to prevent any communication between participants in different dates).

[7] Anecdotally, the difference in taste when brushing one's teeth before or after drinking orange juice makes this phenomenon easy to understand.

The testing took place across five separate L2 courses between January and March 2020 (a small number of volunteers were taken from each class).

4.4 Materials Required

The quality assessment test (QAT, Appendix 2).

Wine and spirits samples (detailed above).

ISO tasting glasses, pens and paper, spittoons, water, and a suitable tasting environment (natural light, no distracting noises or odours; provided by WSET).

Mixed case of wines and spirits to use as incentive for participation.

4.5 Details on the Quality Assessment Test

The quality assessment test was developed specifically for this paper, using a scoring system identical for both wines and spirits. Participants were asked to score each sample across a range of quality indicators, before making a final assessment of overall quality.

For each sample, participants were asked to tick a box indicating their assessment of five criteria (Balance, Length, Intensity, Complexity, Overall Quality). The options for responses were Faulty, Poor, Acceptable, Good, Very Good, Outstanding, as used in the WSET SATs. Each of the participants was provided with a brief definition of each of the five criteria.

The marking criteria were provided by the expert panel. Since a degree of subjectivity still occurs at expert level (Hodgson, 2008), where the expert panel did not reach unanimous conclusions, the participants were awarded one point for any response that matched that of any of the experts, and zero for any response that did not match with any of the experts. The expert ratings were unanimous on 11 of the 40 indices (five factors to consider across eight samples). On the remaining 29 indices the maximum variation was by one level of quality (all within, for example, Very Good or Outstanding). This closeness of scoring is indicative of the expert level of the panel.

4.6 Statistical Analysis

To assess fitness for parametric analysis, the data were assessed for skew and kurtosis [8]. All were within acceptable range of -2.0 to +2.0 (George and Mallery, 2010) (see Appendix 3) indicating normal distribution. No outliers needed to be removed.

A series of t-tests were performed to compare the mean scores of the pre-condition and post-condition groups. Two-tailed t-tests were used because of the possibility that the post-condition scores could decrease rather than increase. This test assesses the probability that any observable result occurs by chance, leading to a 'type 1 error' (false positive, achieved by assigning significance to a result obtained

[8] Skewness is the degree of distortion from the symmetrical bell curve (e.g "normal distribution"), kurtosis is a measure of statistical outliers (George and Mallery, 2010).

at random). Probability was set at 95%, the common standard for statistical significance (George and Mallery, 2010). Since this is a two-tailed test, the 5% room for error is bidirectional, effectively allowing a 2.5% margin for error in either direction.

The pre-condition group was larger than the post-condition group (n=25 vs n=18) [9]. Thus t-tests were performed on the overall mean of each group in an unrelated samples t-test, as well as paired t-tests on the means of the 18 participants who completed both the pre- and post-condition tests. This provided enough data to determine statistical significance (George and Mallery, 2010).

To assess Hypothesis 3, each participant who completed both the pre- and post-condition was assigned a ‘change in score’ value. The mean ‘change in score’ value for the wine samples was compared with that for the spirits samples.

All analysis was conducted by the author using Microsoft Excel.

[9] One drop-out and six participants unable to complete their course due to suspension of teaching following ‘lockdown protocol’ at the outbreak of Covid-19 in the UK.

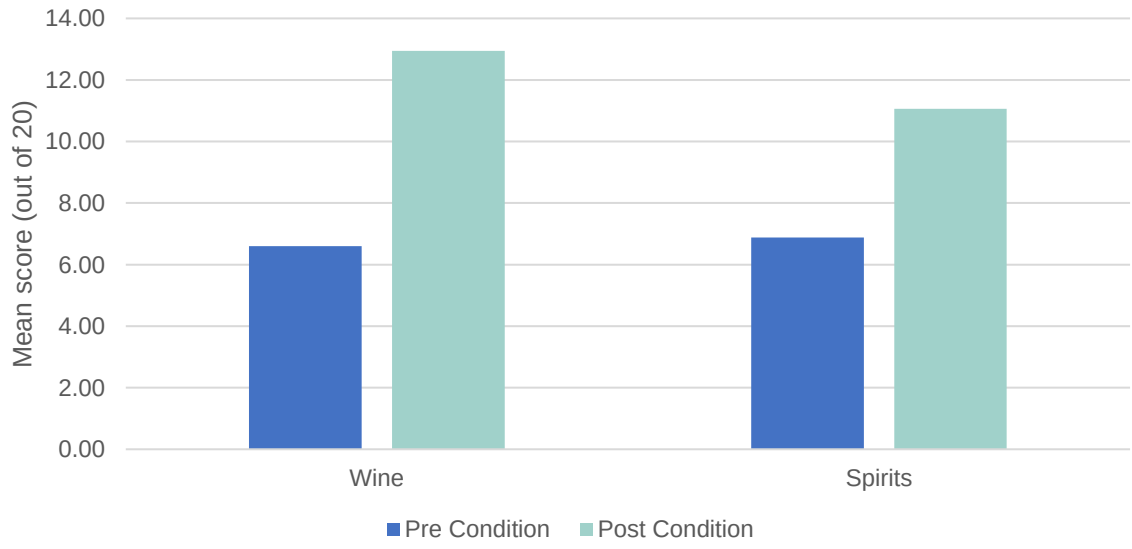
5. Results and Statistical Analysis

Table 1: Mean scores of the pre- and post-condition groups for wines and spirits

	Mean wine score	Mean spirits score
Pre-Condition	6.60	6.88
Post-Condition	12.94	11.06
Percentage increase	96% (P=.00001)	61% (P=.00001)

The mean scores on the QAT for wine were significantly improved in the post-condition group compared to the pre-condition group by 96% (*P*=.00001), moving from an average score of 6.60 (meaning they agreed with the expert rating(s) on an average of 6.6 of the 20 indices for wine) to 12.94. The mean scores in the post-condition group were also significantly improved in the QAT for spirits by 61% (*P*=.00001) compared to the pre-condition group, increasing the average score from 6.88 to 11.12 (Table 1, Fig 1). Full t-tests are included in Appendix 4.

Figure 1: Pre- vs Post-Condition Wine and Spirit Scores

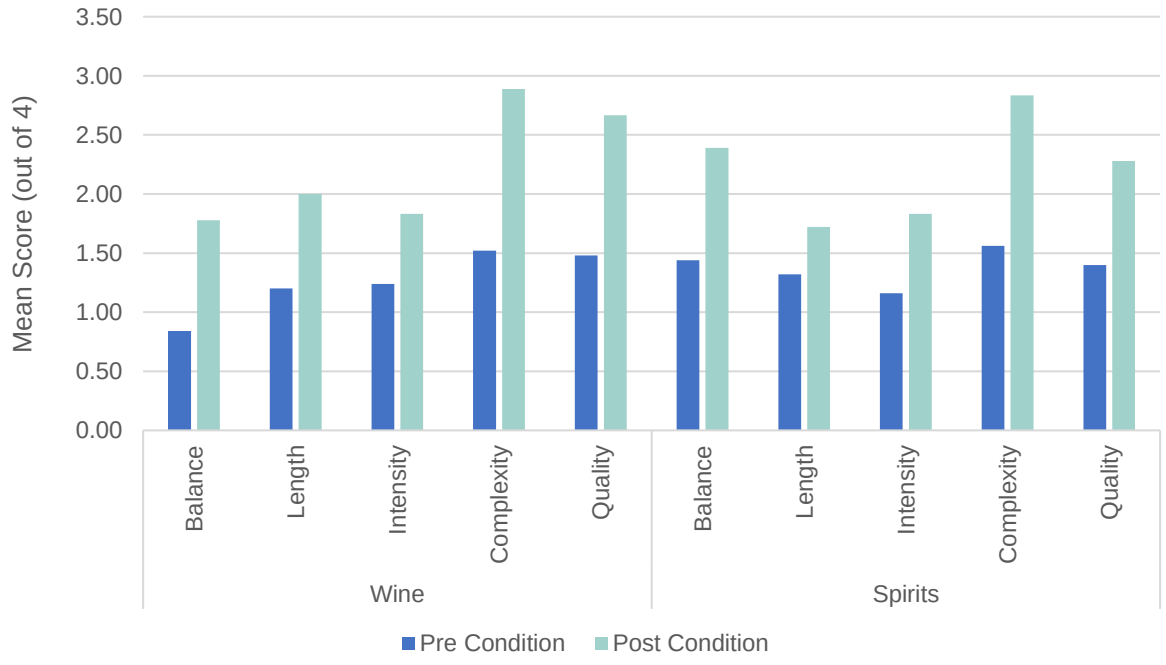


On these data alone **Null Hypotheses 1 and 2 can be rejected**: mean scores in a quality assessment test of both wines and spirits were significantly different (improved) for participants who had completed the WSET Level 2 Award in Wines compared to those who had yet to attend the course.

Null Hypothesis 3 can also be rejected: the changes in the two dependent variables were not of similar magnitude, wine scoring improved 35% (*P*=.05), more than spirits scoring.

Further analysis reveals nuance within these results: the post-condition group performed better in assessing every one of the five individual metrics of quality (Balance, Length, Intensity, Complexity and Overall Quality) in both wine and spirits compared with the pre-condition group (Fig 2).

Figure 2: Pre- vs Post- Condition scores for each index of quality



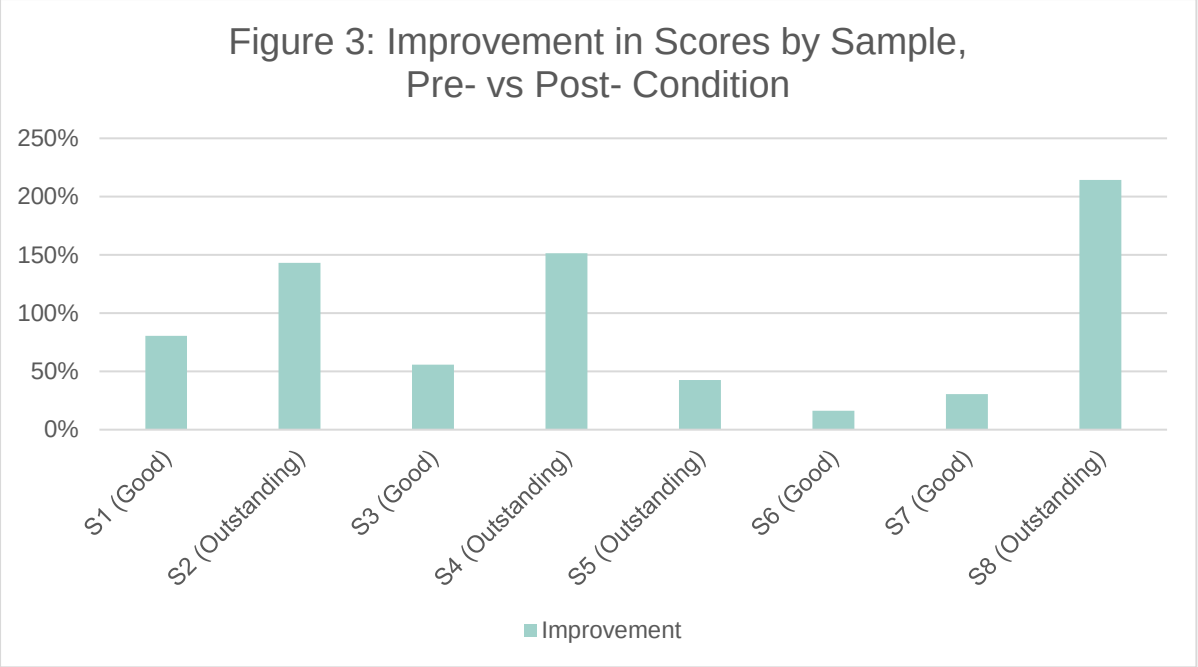
All of these changes were statistically significant (*P*<.05) with the exception of assessing length in spirits where the increase of 30% from 1.32 to 1.73 failed to reach significance (*P*=.09).

In descending order, percentage improvements for each index of quality are shown in Table 2:

Table 2: Indices of quality in descending order of improvement

	Improvement	*P* value
Balance, Wine	112%	*P=.0001*
Complexity, Wine	90%	*P*=.0003
Complexity, Spirits	82%	*P*=.002
Overall Quality, Wine	80%	*P*=.0001
Length, Wine	67%	*P*=.01
Balance, Spirits	66%	*P*=.001
Overall Quality, Spirits	63%	*P*=.002
Intensity, Spirits	58%	*P*=.005
Intensity, Wine	48%	*P*=.028
Length, Spirits	30%	*P*=.09*

*=not significant



The greatest improvements in qualitative assessment of both wines and spirits was seen in those samples rated as highest quality by the expert panels (Fig 3).

5.1 Interpretation

It is clear from the results that participants who have completed the L2 make better qualitative judgements about both wines and spirits than those who have yet to complete the course.

There are several interesting observations within the data collected. Firstly, the indices of quality which are driving the overall shift in performance to the greatest degree are shown below in Table 3.

Table 3: Indices of quality with greatest improvement for wine

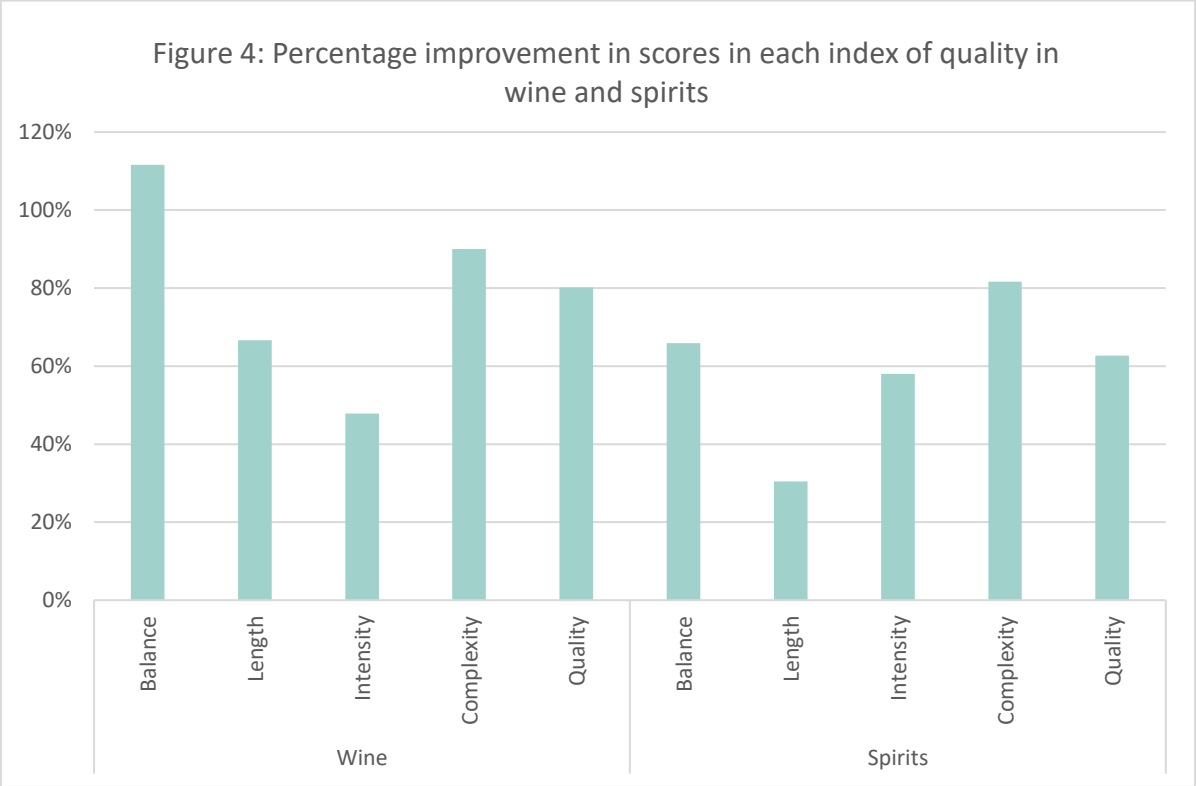
	Improvement	*P* value
Balance, Wine	112%	*P=.0001*
Complexity, Wine	90%	*P*=.0003
Overall Quality, Wine	80%	*P*=.0001

The same indices drive the greatest improvement in qualitative assessment of spirits (Table 4):

Table 4: Indices of quality with greatest improvement for spirits

	Improvement	*P* value
Complexity, Spirits	82%	*P*=.002
Balance, Spirits	66%	*P*=.001
Overall Quality, Spirits	63%	*P*=.002

This is also illustrated visually in Figure 4 (below) which shows the level of improvement in scores (expressed as a percentage of the improvement in scores between the pre- and post-condition) across every tasting metric measured.



It is considered, therefore, that the three indices of Balance, Complexity and Overall Quality are both those with the greatest capacity to improve performance in qualitative analysis in novices, as well as being those elements which benefit most from skill transfer (since at no point were the participants directly taught about tasting spirits). This result is particularly relevant in the context of Hypothesis 3. The average improvement in performance on the wine QAT was greater than the improvement on the spirits QAT, particularly for Length in the post-condition.

Although the quality criteria for spirits and wine are similar, they are not exactly the same, also the experience of tasting spirits is somewhat difference. Judgement of Length may present a particular challenge for those trained on wine as they are less practiced as judging length in a product with much higher alcohol (warming alcohol on the finish of a wine is often seen as a negative (Schuster, 2000)).

One potential mechanism for the improvement in the three most positively affected indices (and their co-occurrence in both wines and spirits) is likely due to the imposition of a structural approach to assessing quality, whereby the practice of assessing individual indices of quality before making a wholistic appraisal can be applied to both categories (Latour, 2018). Another is (increased) vocabulary enabling greater appreciation of the samples (Drew, 2018). Whilst there are undoubtably flavours that are unique to each of the wines and spirits categories, the crossover is vast (see Appendix 1). There is a large body of evidence to support the idea that improving one's flavour vocabulary improves one's ability to experience different tastes. In the 'Sapir-Whorf Hypothesis' it is postulated that language is not merely an instrument for communication, but rather that it directly influences our experience (Whorf, 1958). It follows, therefore, that an enriched flavour vocabulary should facilitate recognition of greater complexity in a wine, spirit, or any other olfactory sensation, when it is present.

When considering balance, a taster has several decisions to make. The various physical metrics within wine include acidity, sugar, alcohol, body and concentration. The interaction of each of these elements creates complex combinations. Therefore, the taster must not only recognise each element, but also apportion relevance to each in the final analysis of the wine / spirit. Accurate analysis of each individual

element is something which can be improved with practice (Pazart, 2014) – hence the increasing importance in weighting of scores for quality assessments in examinations as a professional moves from novice to expert – but the greatest shift that is likely to occur in any professional's career is the point at which they move from not knowing these elements, to knowing them; such is the inevitable flattening of the learning curve as one approaches a level of expertise (Gladwell, 2008).

Whilst the acidity, sugar, alcohol, body and concentration of any spirit will be quite different from any wine, simply being made aware that such elements exist and should be considered clearly leads to some improvement in ability to analyse and identify the attributes.

That 'Overall Quality' should feature in both the wine and spirits lists is something of a tautology, given the significance of the overall improvement in tasting ability in both disciplines. However, it ranks as third most important factor driving improvement in both categories. This indicates that participants have not simply learnt what 'good' or 'outstanding' quality tastes like. Rather, through understanding and assimilation of the concepts of (primarily) balance and complexity, they have been empowered to make more accurate overall judgements about the quality of both wine and spirits, since 'Overall Quality' is effectively a summary of the judgements made on Balance, Length, Intensity and Complexity.

Secondly, at the lower end of the scale, the same two factors in wines and spirits drive improvement with the least impact: Length and Intensity (Tables 5 and 6):

Table 5: Indices of quality with least improvement for wine

	Improvement	*P* value
Length	67%	*P*=.01
Intensity	48%	*P*=.028

Table 6: Indices of quality with least improvement for spirits

	Improvement	*P value*
Intensity	58%	*P=.005*
Length	30%	*P=.09**

These are the closest to 'directly observable' properties of both wine and spirits of the five indices of quality (the others – Balance, Complexity and Overall Quality being relatively conceptual). That is to say, they refer more closely to physical sensation rather than cognitive analysis. Therefore it is both expected and evident that they should be the elements that both require, and benefit most from, practice and repeated calibration from an educator (Rabin, 1988).

Studies have shown that building the neurological associations required to 'learn' aromas and flavours of wine demands repeated exposure (Pazart, 2014). The L2 takes place over three days, and typically involves the tasting of 43 wines. Whilst this

provides some exposure to wine aromas and flavours, it is clearly a small fraction of the experience of an expert within the field. For example, the WSET Level 4 Diploma in Wines suggests students taste 212 samples (of which 142 are classed as 'essential') over study time of 500 hours. It is therefore suggested that these elements benefit most from direct experience – something notably lacking in the novice – and as such are expected to show the least improvement via skill transfer.

The third observation focusses on the samples themselves. The paired samples were chosen specifically to represent a quality gradient in that, for experts, there was a marked clear distinction in quality between them. It is notable that, by a considerable margin, the greatest improvements in participants' performance in the post-condition group are within the highest quality samples.

Table 7 (overleaf) shows the level of improvement in the post-condition scores against the expert judgement of the spirits[10].

[10] (note: this judgement of quality is a rudimentary function of the expert's mean score, whereby the maximum potential score is 30. As per the coding of the participants scoring: 1 = Faulty, 2 = Poor, 3 = Acceptable, 4 = Good, 5 = Very Good, 6 = Outstanding, expressed as a total against the five indices of quality: Balance, Length, Intensity, and Complexity. The scores of all four experts were then added to give a score out of 120 which is then expressed as a percentage.)

Table 7: Expert ranking and mean participant improvement for each sample

	Expert Ranking	Improvement
Sample 8 (Brown Spirit, Outstanding)	98%	214%
Sample 4 (Red Wine, Outstanding)	96%	151%
Sample 2 (White Wine, Outstanding)	94%	143%
Sample 5 (Clear Spirit, Outstanding)	90%	43%
Sample 7 (Brown Spirit, Good)	62%	30%
Sample 1 (White Wine, Good)	61%	81%
Sample 3 (Red Wine, Good)	54%	56%
Sample 6 (Clear Spirit, Acceptable)	47%	16%

It is immediately apparent from Table 7 that the greatest gains in improvement of quality assessment occur in the post-condition group when asked to assess both wines *and* spirits of superior quality. This is, in part, a reflection of the poor rates of agreement between novices and experts for Outstanding samples in the pre-condition, hence a great improvement is seen for the Outstanding samples. However, the accuracy of the quality assessment for both Good and Outstanding samples is relatively similar in the post-condition group. This demonstrates that it is not the case that the novices became excellent at assessing the quality of Outstanding samples following their training; rather that they were notably poor at it beforehand.

Sample 6 sees the smallest increase in scores, improving only 16% vs the pre-condition group, which fails to achieve statistical significance (*P=.09).* Whilst the sample is generally ‘acceptable’ (not only in terms of the ‘BLIC’ analysis, but also

well made, free from faults and commercially successful), it relies heavily on the addition of flavouring post-distillation. It is notable, therefore, that one of the features possessed by ‘expert’ tasters and lacked by ‘novices’ is an increased sensitivity to synthetic flavours (Smith, 2012). The implication here is that whilst the novices have increased their ability to assess quality objectively, they have yet to increase their tasting experience widely enough to be able to distinguish reliably between natural aromas and synthetic additions (Plailly et al., 2012).

As a more anecdotal observation, the ‘good’ samples were the kind of wines and spirits often described as ‘crowd-pleasers’. Within the context of this observations, the phrase ‘crowd-pleaser’ almost becomes a synonym for the definition of ‘good’, but with an important addition: well-made, free from faults and commercially successful – but lacking the complexity, balance and overall quality desired by a more proficient taster. In general, in the post-conditions mean scores rose across all samples, suggesting a greater appreciation for the wines and spirits of all quality levels after the course, though to a greater degree in higher quality samples.

At an individual level, not all participants improved their scores in the post-condition test. One participant scored lower in the post-condition for wine (pre-condition score = 8, post-condition score = 6, a decrease of 25%) but had a similar shift in the opposite direction for spirits (pre-condition score = 7, post-condition score = 9, increase of +29%).

Three participants (highlighted in Table 8, below) scored lower in the post-condition test for spirits:

Table 8: Individual participant scores in pre- and post-condition for spirits

Participant No.	Spirits score pre-condition	Spirits score post-condition	Percentage shift
1	6	15	150%
2	8	9	13%
3	9	15	67%
4	8	11	38%
5	12	10	-17%
6	3	9	200%
7	7	8	14%
8	7	9	29%
9	8	12	50%
10	8	9	13%
11	4	14	250%
12	8	16	100%
13	5	14	180%
14	2	8	300%
15	9	12	33%
16	12	10	-17%
17	6	13	117%
18	10	5	-50%

There was no trend or consistency in the individual indices of quality driving this reduction in scores, nor did they have a significant impact on the mean of the post-condition group, but it is an interesting observation that those participants with a net reduction in spirits scores were those who scored most highly in the pre-condition.

This can be explained in simple mathematical terms: regression to the mean. This is the phenomenon whereby if a random variable is extreme within its sample upon first

measurement, it will be closer to the mean upon second measurement (Barnett, 2005). Given that the pre-condition group were untrained, there may be a degree of 'guess-work' in their responses which introduces a random factor. This means that there is some degree of chance in the pre-condition and it just so happened that some students performed well. The reason for them doing worse in the post-condition is partly due to them doing so well in the pre-condition (two of the three candidates actually scored well in the post-condition, just not quite as well as in the pre-condition). The post-condition is a slightly better reflection of actual ability, since the more times one performs a task the degree of chance results decrease, providing a better the reflection of actual ability.

5.2 Limitations

All of the participants of this investigation had invested either time, money, or both, into wine education. Therefore, the degree to which they can be considered 'novices' is debatable. Whilst they declared no previous training in either wine or spirits, it would be remiss to disregard the fact that the sample is not representative of the population at large.

In particular, the sample may be expected to have already realised, consciously or otherwise, the benefits of education on consumption enjoyment (Latour, 2018) which may be a motivator for their choice to take on the challenge of the WSET L2.

Statistically speaking, the drop-out rate of seven out of 25 participants[11] meant that it was not possible to fully analyse the performance of all 25 pre-condition results

[11] Due to courses being called off following the UK lockdown for Covid-19

(since only 18 were present for the post-condition). That factor notwithstanding, both the means of the total groups and the means of the omnipresent participants still provided statistically significant results (143% improvement in wine scoring, *P*=.0004, 82% improvement in spirit scoring *P=.0017, n=18* in the individuals who took the test in both conditions). A greater sample size would increase the generalisability of these results. Furthermore, the study included a limited number of samples. Hence, repetition of the experiment with a greater number and wider range of samples (from different drinks categories) would provide greater confidence in the skill transfer effect.

A noted limitation of the analysis is that, due to confidentiality, it was not possible to compare changes in QAT scores with the grades the participants achieved upon completion of the L2. However, the L2 has a theory-only examination, so the examination results would provide limited information about the individuals' tasting abilities.

6. Conclusions and Recommendations

This study aimed to address three questions:

1. To what extent are students who have completed the Wine and Spirits Education Trust (WSET) Level 2 Award in Wines significantly better at assessing the quality of wine than those who have yet to attend the course?

2. To what extent are students who have completed the WSET Level 2 Award in Wines significantly better at assessing the quality of spirits than those who have yet to attend the course?

3. Are any changes in these two dependent variables of similar magnitude?

It was seen that completing the WSET L2 significantly improves students' abilities to assess both wine *and* spirits qualitatively (indicated by 96% and 61% improvement in quality assessment scores, respectively), and that wine assessment improves to a greater degree (+35%). All three null hypotheses were rejected.

It is clear from the results that wine tasting utilises skills which can be taught, as shown from the 96% (P=.00001) increase in scores in the pre vs post-condition performance. Furthermore, it is clear that these skills are, mostly, transferable to spirits tasting, demonstrated by the 61% (P=.00001) improvement in scores in the post-condition group spirits tasting.

It has been shown that assessments of complexity and balance, as well as overall assessment of quality, benefit from skill transfer in novices more so than those of

length and intensity. This suggests that the ideal time to capitalise on the skill transfer of these judgments is in the novice phase of skill acquisition[12].

With this in mind, there is a strong argument for wine and spirits education to co-occur, especially at the novice level. With the analytical framework of a systematic approach to assessing quality in place, the addition of practical experience of tasting providing exposure to the physical attributes of spirits (in this case length and intensity) tasting ability would be expected to increase yet further.

Furthermore, educators (and students) of wine and spirits would benefit from understanding the experience level of students in different categories, since skill transfer is likely to accelerate acquisition of tasting accuracy.

The results indicate that tasters can expect to benefit from 'cross-training' in different categories. The findings directly demonstrate the positive benefits of wine education on qualitative analysis of spirits; there is no reason to expect that this skill transfer benefit should not also exist in the opposite direction (spirits training improving wine performance). Further, this effect can reasonably be expected to extend into other alcoholic beverages (e.g. sake, beer, cider etc.) as well as other nuanced non- (and low-) alcoholic beverages (e.g. tea, coffee, kombucha) where a framework similar to BLIC already exists, or would be suitable, for assessing quality. However, further research is needed to confirm this.

[12] It may be the case that judgements of length and intensity benefit to a greater degree in the enthusiast / expert – a topic for further investigation.

Given the existing evidence that greater understanding of flavour increases enjoyment (Drew, 2018) (West, 1996) the implication is that wine education can also lead to increased appreciation of spirits (and, presumably, other beverages). The greatest improvements in tasting accuracy were seen in the highest quality wines and spirits, which leads to the conclusion that education not only increases appreciation of wines and spirits, but that this phenomenon disproportionately applies to higher quality products. Moreover, it has been demonstrated that the more educated consumer is prepared to spend more on wines and spirits (Jackson, 2017), creating an argument that the higher quality wine and spirits industry therefore particularly benefits from any, and all, wine and spirits training.

These observations have direct implications for a range of audiences. Wine and spirits producers who create higher quality products should engage in educational activities with their consumers so that they are better equipped to appreciate the full extent of the quality in their glass, consumers can increase their tasting skills (and, thereby, likely their enjoyment too) of a range of products by seeking education in any one specific category, and educators can benefit from understanding the wider benefits that wine education can offer to students.

6.1 Recommendations

Further investigation could assess skill transfer in the opposite direction (spirits tasting training improving wine tasting ability), as well as transfer to different drinks categories, both alcoholic and otherwise.

Assessing the efficacy of skill transfer at differing levels of expertise would also prove interesting. For example, if the level of wine education increases, does the benefit within spirits tasting continue to improve, or is there a ceiling to the improvement via skill transfer such as seen in the impaired acquisition of fluency in third language acquisition (Selinker and Baumgartner-Cohen, 1995)? Further, it would be of interest to investigate the permanence of the 'transferred' skills vs the taught skills: does the improvement in spirits quality assessment ability persist for as long as the (directly taught) assessment of quality in wines?

Finally, it may be the case that learning to taste in a new category (e.g. spirits) can go on to improve performance of experts *within* their area of expertise. Further investigation could highlight methods in which 'cross-training' can improve expert tasting performance which would be of particular interest to those involved in tasting competitions and preparation for notoriously challenging tasting exams such as the MS and MW.

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8. Appendix

8.1. WSET SATs for wine and spirits (L2)

WSET Level 2 Systematic Approach to Tasting Wine®

APPEARANCE		
Intensity		pale – medium – deep
Colour	white	lemon – gold – amber
	rosé	pink – pink-orange – orange
	red	purple – ruby – garnet – tawny

NOSE	
Intensity	light – medium – pronounced
Aroma characteristics	e.g. primary, secondary, tertiary

PALATE	
Sweetness	dry – off-dry – medium – sweet
Acidity	low – medium – high
Tannin	low – medium – high
Alcohol	low – medium – high
Body	light – medium – full
Flavour intensity	light – medium – pronounced
Flavour characteristics	e.g. primary, secondary, tertiary
Finish	short – medium – long

CONCLUSIONS	
Quality	poor – acceptable – good – very good – outstanding

WSET

Issue 1, 2019

WSET Level 2 Wine-Lexicon:

supporting the WSET Level 2 Systematic Approach to Tasting Wine®

DESCRIBING AROMA AND FLAVOUR	
Primary Aromas and Flavours The aromas and flavours of the grape and alcoholic fermentation	
Floral	blossom, rose, violet
Green fruit	apple, pear, gooseberry, grape
Citrus fruit	grapefruit, lemon, lime, orange
Stone fruit	peach, apricot, nectarine
Tropical fruit	banana, lychee, mango, melon, passion fruit, pineapple
Red fruit	redcurrant, cranberry, raspberry, strawberry, red cherry, red plum
Black fruit	blackcurrant, blackberry, blueberry, black cherry, black plum
Herbaceous	green bell pepper (capsicum), grass, tomato leaf, asparagus
Herbal	eucalyptus, mint, fennel, dill, dried herbs
Spice	black/white pepper, liquorice
Fruit ripeness	unripe fruit, ripe fruit, dried fruit, cooked fruit
Other	wet stones, candy
Secondary Aromas and Flavours The aromas and flavours of post-fermentation winemaking	
Yeast (lees, autolysis, flor)	biscuit, pastry, bread, toasted bread, bread dough, cheese, yogurt
Malolactic conversion	butter, cream, cheese
Oak	vanilla, cloves, coconut, cedar, charred wood, smoke, chocolate, coffee
Tertiary Aromas and Flavours The aromas and flavours of maturation	
Red wine	dried fruit, leather, earth, mushroom, meat, tobacco, wet leaves, forest floor, caramel
White wine	dried fruit, orange marmalade, petrol (gasoline), cinnamon, ginger, nutmeg, almond, hazelnut, honey, caramel
Deliberately oxidised wines	almond, hazelnut, walnut, chocolate, coffee, caramel

WSET Level 2 Systematic Approach to Tasting Spirits®

APPEARANCE	
Clarity	clear – hazy
Intensity	water-white – pale – medium – deep – opaque
Colour	colourless – lemon – gold – amber – brown pink – red – orange – yellow – green – blue – purple – brown – black
Other observations	e.g. louching

NOSE	
Condition	clean – unclean
Intensity	neutral – light – medium – pronounced
Aroma characteristics	e.g. raw material, processing, oak and maturation

PALATE		
Sweetness		dry – off-dry – medium – sweet
Texture		e.g. rough, smooth, watery, mouthfilling, warming
Flavour intensity		neutral – light – medium – pronounced
Flavour characteristics		e.g. raw material, processing, oak and maturation
Finish	*length*	short – medium – long
	nature	neutral – simple – some complexity – very complex

CONCLUSIONS	
Quality level	faulty – poor – acceptable – good – very good – outstanding

WSET

Issue 1, 2017

WSET Level 2 Spirit-Lexicon:

supporting the WSET Level 2 Systematic Approach to Tasting Spirits

AROMA AND FLAVOUR	
Raw Materials	
Corn	butterscotch, sweetcorn, popcorn, caramel, burnt sugar, toffee, menthol
Malted barley	husk, porridge, barley, malt, flour
Rye	rye bread, gingerbread, peppercorn, allspice
Grape	grape, fig, prune, raisin, sultana, citrus elderflower, orange blossom, rose, violet, perfume, lavender, lilac, dried flowers
Agave	agave, peppercorn, root vegetable, olive
Sugar cane	grass, caramel, burnt sugar, toffee, treacle, molasses
Fruits	apple, pear, apricot, peach, plum, cherry, marzipan strawberry, raspberry, blackcurrant, blackberry orange, lemon
Botanicals	juniper, citrus peel, root, earthy, cumin, peppercorn aniseed, fennel, liquorice cinnamon, cloves, ginger, nutmeg, cardamom coriander, basil, rosemary, thyme, sage, lemongrass, mint
Processing (raw material, fermentation, distillation)	
Smoke	peat, medicinal, smoked fish, smoky, seaweed smoke, char, charred vegetables
Esters	banana, apple, pear, floral, pineapple, melon, mango, pear drops, nail varnish
Other	pungent solvent (prickling sensation on the nose), plastic, cheese, sweaty, burnt rubber
Oak and Maturation	
Oak	vanilla, toast, coffee, cedar, char, spice, sherry, sawdust, coconut, nuts
Age/rancio	fruit cake, candied fruits, leather, tobacco, wet leaves, mushroom, forest floor, meaty, yeast extract, wood polish

TEXTURE/OTHER			
Does the spirit feel:	• rough, harsh, sharp?	• mouthfilling, full?	• smooth, silky?
	• warming?	• watery, thin?	
Other	bitterness		

8.2. Quality Assessment Test

Tasting Quality in Different Drinks Categories

Introduction

Thank you for agreeing to take part in my Master of Wine Research Paper.

This is an investigation focussed on appraisal of quality in wines and spirits. Your responses will be entirely anonymous.

Please complete your answers legibly.

Current experience

Have you ever attended / experienced a formal **spirits** training? If so, please give details of the course and approximate date:

…….(e.g WSET L1, Summer 2019)……

Have you ever attended / experienced a formal **wine** training? If so, please give details of the course and approximate date:

……

Tasting test

In front of you are eight glasses, numbered 1-8, left to right.

For each sample, please take a small taste (and use the spittoon provided). After each tasting, place a mark in the box which you feel most accurately reflects the sample you are tasting.

Only ONE box should be marked for each of the five criteria (e.g acceptable *or* good).

Please note that whilst there are similarities with WSET language here, this is not a WSET specific grid, nor are your answers in any way connected to your WSET grade.

Definition of terms:

Balance: the degree to which the components of the wine / spirit complement each other, no single part diminishing the others; well-integrated alcohol, sweetness vs acidity etc.

Length: how long the flavour of the wine / spirit persists on the palate

Intensity: both the amount and definition of the flavour, sometimes thought of as ‘concentration’

Complexity: broad ranging rather than singular flavour

Overall quality: your overall objective impression of the quality of the sample

Sample 1 (white wine)

	Faulty	Poor	Acceptable	Good	Very Good	Outstanding
Balance						
Length						
Intensity						
Complexity						
Overall Quality						

Sample 2 (white wine)

	Faulty	Poor	Acceptable	Good	Very Good	Outstanding
Balance						
Length						
Intensity						
Complexity						
Overall Quality						

Sample 3 (red wine)

	Faulty	Poor	Acceptable	Good	Very Good	Outstanding
Balance						
Length						
Intensity						
Complexity						
Overall Quality						

Sample 4 (red wine)

	Faulty	Poor	Acceptable	Good	Very Good	Outstanding
Balance						
Length						
Intensity						
Complexity						
Overall Quality						

Sample 5 (clear spirit)

	Faulty	Poor	Acceptable	Good	Very Good	Outstanding
Balance						
Length						
Intensity						
Complexity						
Overall Quality						

Sample 6 (clear spirit)

	Faulty	Poor	Acceptable	Good	Very Good	Outstanding
Balance						
Length						
Intensity						
Complexity						
Overall Quality						

Sample 7 (dark spirit)

	Faulty	Poor	Acceptable	Good	Very Good	Outstanding
Balance						
Length						
Intensity						
Complexity						
Overall Quality						

Sample 8 (dark spirit)

	Faulty	Poor	Acceptable	Good	Very Good	Outstanding
Balance						
Length						
Intensity						
Complexity						
Overall Quality						

8.3. Skew / Kurtosis Report

Wine Scores, Pre-Condition	
Mean	6.480
Standard Error	0.749
Median	6
Mode	10
Standard Deviation	3.743
Sample Variance	14.010
Kurtosis	-0.345
Skewness	0.165
Range	15
Minimum	0
Maximum	15
Sum	162.000
Count	25.000
Confidence Level(95.0%)	1.545

Wine Scores, Post-Condition	
Mean	12.556
Standard Error	1.017
Median	14
Mode	17
Standard Deviation	4.314
Sample Variance	18.614
Kurtosis	-1.129
Skewness	-0.656
Range	12
Minimum	5
Maximum	17
Sum	226.000
Count	18.000
Confidence Level(95.0%)	2.146

Spirits Scores, Pre-Condition	
Mean	6.880
Standard Error	0.514
Median	7
Mode	8
Standard Deviation	2.571
Sample Variance	6.610
Kurtosis	0.229
Skewness	-0.016
Range	10.000
Minimum	2
Maximum	12
Sum	172.000
Count	25.000
Confidence Level(95.0%)	1.061

Spirits Scores, Post-Condition	
Mean	11.056
Standard Error	0.707
Median	11
Mode	9
Standard Deviation	2.999
Sample Variance	8.997
Kurtosis	-0.670
Skewness	-0.031
Range	11.000
Minimum	5
Maximum	16
Sum	199.000
Count	18.000
Confidence Level(95.0%)	1.492

8.4: t-test Reports

t-test: Two-Sample Assuming Equal Variances

Group Level Wine Pre vs Post

	Wine Pre	*Wine Post*
Mean	6.480	12.55556
Variance	14.010	18.61438
Observations	25.000	18.00000
Pooled Variance	15.911	
Hypothesized Mean Difference	0.000	
df	41.000	
t Stat	-4.9260	
P(T<=t) one-tail	0.00001	
t Critical one-tail	1.68288	
	0.0000	
P(T<=t) two-tail	**1**	
t Critical two-tail	2.01954	

t-test: Two-Sample Assuming Equal Variances

Group Level Spirits Pre vs Post

	S.Pre	*S.Post*
Mean	6.880	11.11
Variance	6.610	9.40
Observations	25.000	18.00
Pooled Variance	7.766	
Hypothesized Mean Difference	0.000	
df	41.000	
t Stat	-4.9115	
P(T<=t) one-tail	0.00001	
t Critical one-tail	1.68288	
	0.0000	
P(T<=t) two-tail	**1**	
t Critical two-tail	2.01954	

t-test: Two-Sample Assuming Equal Variances
Group Level Wine Balance Pre vs
Post

	Wine Bal	*W.Bal Post*
Mean	0.840	1.778
Variance	0.640	1.007
Observations	25.000	18.000
Pooled Variance	0.792	
Hypothesized Mean Difference	0.000	
df	41.000	
t Stat	-3.409	
P(T<=t) one-tail	0.001	
t Critical one-tail	1.683	
P(T<=t) two-tail	**0.001**	
t Critical two-tail	2.020	

t-test: Two-Sample Assuming Equal Variances
Group Level Spirits Balance Pre vs
Post

	Sp Bal	*S.Bal.Pos*
Mean	1.440	2.389
Variance	0.840	0.605
Observations	25.000	18.000
Pooled Variance	0.742	
Hypothesized Mean Difference	0.000	
df	41.000	
t Stat	-3.563	
P(T<=t) one-tail	0.000	
t Critical one-tail	1.683	
P(T<=t) two-tail	**0.001**	
t Critical two-tail	2.020	

t-test: Two-Sample Assuming Equal Variances
Group Level Wine Length Pre vs
Post

	Wine Len	*W. Len Post*
Mean	1.200	2.000
Variance	0.917	0.941
Observations	25.000	18.000
Pooled Variance	0.927	
Hypothesized Mean Difference	0.000	
df	41.000	
t Stat	-2.688	
P(T<=t) one-tail	0.005	
t Critical one-tail	1.683	
P(T<=t) two-tail	**0.010**	
t Critical two-tail	2.020	

t-test: Two-Sample Assuming Equal Variances

	Sp Leng	*S.Len.Pos*
Mean	1.32	1.72
Variance	0.39	0.80
Observations	25.00	18.00
Pooled Variance	0.56	
Hypothesized Mean Difference	0.00	
df	41.00	
t Stat	-1.74	
P(T<=t) one-tail	0.05	
t Critical one-tail	1.68	
P(T<=t) two-tail	**0.09**	
t Critical two-tail	2.02	

t-test: Two-Sample Assuming Equal Variances
Group Level Wine Intensity Pre vs Post

	Wine Int	*W.Int Post*
Mean	1.240	1.833
Variance	0.690	0.735
Observations	25.000	18.000
Pooled Variance	0.709	
Hypothesized Mean Difference	0.000	
df	41.000	
t Stat	-2.280	
P(T<=t) one-tail	0.014	
t Critical one-tail	1.683	
P(T<=t) two-tail	**0.028**	
t Critical two-tail	2.020	

t-test: Two-Sample Assuming Equal Variances
Group Level Spirits Intensity Pre vs Post

	Spi Int	*S.Int.Pos*
Mean	1.160	1.833
Variance	0.473	0.618
Observations	25.000	18.000
Pooled Variance	0.533	
Hypothesized Mean Difference	0.000	
df	41.000	
t Stat	-2.983	
P(T<=t) one-tail	0.002	
t Critical one-tail	1.683	
P(T<=t) two-tail	**0.005**	
t Critical two-tail	2.020	

t-test: Two-Sample Assuming Equal Variances
Group Level Wine Complexity Pre vs Post

	Wine Comp	*W.ComPost*
Mean	1.520	2.888
Variance	1.510	0.928
Observations	25.000	18.000
Pooled Variance	1.268	
Hypothesized Mean Difference	0.000	
df	41.000	
t Stat	-3.931	
P(T<=t) one-tail	0.000	
t Critical one-tail	1.682	
P(T<=t) two-tail	**0.0003**	
t Critical two-tail	2.019	

t-test: Two-Sample Assuming Equal Variances
Group Level Spirits Complexity Pre vs Post

	Spir Comp	*S.Com.Pos*
Mean	1.560	2.833
Variance	0.840	1.205
Observations	25.000	18.000
Pooled Variance	0.991	
Hypothesized Mean Difference	0.000	
df	41.000	
t Stat	-4.136	
P(T<=t) one-tail	0.0001	
t Critical one-tail	1.682	
P(T<=t) two-tail	**0.0002**	
t Critical two-tail	2.019	

t-test: Two-Sample Assuming Equal Variances
Group Level Wine Overall Quality Pre vs Post

	Wine qual	*W.QuaPost*
Mean	1.480	2.666
Variance	0.760	0.823
Observations	25.000	18
Pooled Variance	0.786	
Hypothesized Mean Difference	0.000	
df	41.000	
t Stat	-4.3291	
P(T<=t) one-tail	0.000	
t Critical one-tail	1.682	
P(T<=t) two-tail	**0.0001**	
t Critical two-tail	2.0195	

t-test: Two-Sample Assuming Equal Variances
Group Level Spirits Overall Quality Pre vs Post

	Spi Qual	*S.Qual.Pos*
Mean	1.400	2.278
Variance	0.750	0.801
Observations	25.000	18.000
Pooled Variance	0.771	
Hypothesized Mean Difference	0.000	
df	41.000	
t Stat	-3.234	
P(T<=t) one-tail	0.001	
t Critical one-tail	1.683	
P(T<=t) two-tail	**0.002**	
t Critical two-tail	2.020	

t-test: Paired Two Sample for Means (Hypothesis 3)

	Variable 1	*Variable 2*
Mean	6.06	3.72
Variance	20.53	18.09
Observations	18.00	18.00
Pearson Correlation	0.14	
Hypothesized Mean Difference	0.00	
df	17	
t Stat	1.72	
P(T<=t) one-tail	0.05	
t Critical one-tail	1.74	

8.5: Research Paper Proposal

IMW Research Paper Proposal Submission Form			
Student ID	**24875**	**Date of submission**	**5.12.2019**
RPP Version No	**3**	**Name of Advisor**	**Victoria Burt**
Note: RPPs must be submitted via your Advisor to the IMW			
Proposed Title			
Does wine tasting education improve performance in qualitative assessment of spirits?			
Research Questions: Define the subject of your Research Paper and specify the specific research questions you plan to pursue. (No more than 200 words)			
An investigation into whether wine tasting education (specifically, the WSET Level 2 Award in Wine: 'L2') improves a student's ability to make quality assessments of beverages from a different drinks category – namely, spirits. This paper will first explore, through literature review, what is meant by 'quality' in both wines and spirits and how quality is measured. Next, again through literature review, it will explore and critically assess the body of evidence concerning 'wider benefits' of learning (e.g. indirect improvement in skills through training in different areas). It then seeks to examine people's ability to assess quality in wines and spirits before and after training in only wines. **Specific research questions:** • To what extent are students who have attended the WSET L2 significantly better at assessing the quality of **wine** than those who have yet to attend the course?			

- To what extent are students who have attended the WSET L2 significantly better at assessing the quality of **spirits** than those who have yet to attend the course?
- Are any changes in these two dependent variables of similar magnitude?

Background and Context: Explain what is currently known about the topic and address why this topic requires/offers opportunities for further research. (No more than 200 words)

The hypothesis that teaching a person tasting skills within one category (wine) should result in an improvement in their ability to taste other things (e.g spirits, sake, beer, etc.) has face validity. Despite many anecdotal examples, this phenomenon appears not to have been empirically tested.

By analogy, some studies suggest that learning a second language makes acquisition of a third easier (Abu-Rabia and Sanitsky, 2019; De Bot and Jaensch, 2013), although conflicting findings have also arisen – attributed to 'confusion' effects whereby the scholar erroneously incorporates second language structure and / or lexicon into third language discourse (Selinker and Baumgartner-Cohen, 2013).

Further analogy draws on studies showing that learning one musical instrument facilitates skill acquisition when learning another (Lee, 2007). Further still, many studies demonstrate that learning a musical instrument improves skill acquisition in other fields (Chan, Ho and Cheung, 1998; Piro and Ortiz, 2009; Rauscher et al., 1997)

In both analogies (languages and musical instruments) the subject learns a 'system', followed by the application.

This research paper will investigate the efficacy of learning a ‘tasting system’ within one specific scope (wine), and test whether it can indirectly improve students’ performance in qualitative assessment of samples from another drinks category (spirits).

Sources: Identify the nature of your source materials (official documents, books, articles, other studies, etc.) and give principle sources if appropriate. (No more than 150 words)

Abu-Rabia, S. and Sanitsky, E. (2019). *Bilinguals find it easier to learn a third language*. [online] ScienceDaily. Available at: https://www.sciencedaily.com/releases/2011/02/110201110915.htm [Accessed 16 Oct. 2019].

Chan, A., Ho, Y. and Cheung, M. (1998). Music training improves verbal memory. *Nature*, 396(6707), pp.128-128.

De Bot, K. and Jaensch, C. (2013). What is special about L3 processing? *Bilingualism: Language and Cognition*, 18(2), pp.130-144.

Lee, E. (2007). A study of the effect of computer assisted instruction, previous music experience, and time on the performance ability of beginning instrumental music students. PhD Dissertation. The University of Nebraska, Lincoln.

Piro, J. and Ortiz, C. (2009). The effect of piano lessons on the vocabulary and verbal sequencing skills of primary grade students. *Psychology of Music*, 37(3), pp.325-347.

Rauscher, F., Shaw, G., Levine, L., Wright, E., Dennis, W. and Newcomb, R. (1997). Music training causes long-term enhancement of preschool children’s spatial–temporal reasoning. *Neurological Research*, 19(1), pp.2-8.

Selinker, L. and Baumgartner-Cohen, B. (1995). Multiple language acquisition: ‘Damn it, why can’t i keep these two languages apart?’. *Language, Culture and Curriculum*, 8(2), pp.115-121.

Further sources may include the following journals and books, as well as expert interviews:

European Journal of Cognitive Psychology

Psychonomic Bulletin & Review

Language Learning

English Language Teaching

Qualitative Market Research: An International Journal

International Journal of Wine Marketing

Journal of Wine Economics

International Journal of Wine Business Research

Wine tasting. Saint Louis: Elsevier Science.

WSET (2019) Wines: Looking behind the label. London: WSET

Research Methodology: Please detail how you will identify and gather the material or information necessary to answer the research question(s) and discuss what techniques you will use to analyse this information. (No more than 500 words)

Context:

The WSET Level 2 Award in Wines ('L2') is "a beginner- to intermediate-level qualification exploring wines, suitable for industry professionals and wine enthusiasts" (Wsetglobal.com, 2019).

Within the course, students are taught to make objective assessments of the quality of wines. Assessment is a 50-question multiple choice examination of theory knowledge only (no tasting element).

Experimental design:

Participants will be drawn from a pool of L2 students, studying at the WSET School London[13], commencing their studies between January and March 2020.

[13] The author has taught spirits courses at Diploma level at the WSET for several years. WSET have agreed to provide access to its students for the purposes of this Research Paper, as well as the tasting room and equipment listed.

The pool has been identified as a group which is unlikely to have experience of formal spirits education (until August 2019 spirits were part of the L2 syllabus, making it likely that L3 students would have had at least *some* formal spirits tuition).

A brief questionnaire will identify any students who have already received formal spirits education; their results will be discarded.

All participants will be asked to complete a quality assessment test for both wines and spirits, using a test specifically designed for this research. The test will be administered immediately prior to the participants commencing their L2, and again after their course is complete. No performance feedback will be given to participants in order to minimize any unintentional training benefit from re-testing.

A pilot test of six participants will be conducted to assess the level of variance expected. A power calculation will then inform the sample size required in order to enable significance of results[14]. This approach has been advised by a clinical cancer research doctor who routinely investigates treatment models, comparing results before and after various treatments.

Statistical analysis:

Pending confirmation of sample size, the likely statistical analysis begins with Shapiro-Wilks test of normality to test for normative distribution and homogeneity of variance assessed by Levene's Test for Equality of Variances. Multiple related t-tests will then determine whether there is a significant difference between the means of the two sets of results, in order to address the research questions.

[14] "Best guess" guidance was a sample of 12-20 participants, but this is absolutely dependant on the level of variance discovered in the pilot phase.

Participants will be assigned a participant number to allow for further analysis or performance changes, should they occur. For example, it may be that the improvement in spirits analysis is disproportionately greater in those participants with greater improvements in wine analysis.

Details on the Quality Assessment Test:

The quality assessment test will be developed and piloted specifically for this paper. It will use a scoring system which is identical for both wines and spirits. Development will involve pilot tests with micro-groups (three expert, three novices) until magnitude of variance indicates that the study can be carried out satisfactorily with a sample group of achievable size.

Participants will score each sample across a range of quality indicators, before making a final assessment of overall quality. The test will include two samples of different quality levels from four different categories (white wine, red wine, clear spirits, dark spirits). Participant answers will be marked against those of an expert panel: three wine and three spirit experts, each of whom holds a minimum qualification of the WSET Diploma and has experience of judging quality at international (for an awarding body such as IWSC, ISC and / or Decanter).

Materials Required:

The quality assessment test (in development)

Wine and spirits samples (the same in both tests).

Glassware, pens and paper, spittoons, water, and a suitable tasting environment (provided by the WSET).

Mixed case of wines and spirits to use as incentive for participation.

Potential to Contribute to the Body of Knowledge on Wine: Explain how this Research Paper will add to the current body of knowledge on this subject. (No more than 150 words)

It is self-evident that learning about wine will increase a student's ability to understand, analyse, communicate about, and even enjoy wine. If it can be shown that wine education can also bring about measurable, statistically significant improvements in cross-category tasting, it may build a greater argument in favour of professionals from indirectly associated professions to further develop their wine knowledge, increasing the audience for wine education.

Proposed Time Schedule/Programme: This section should layout the time schedule for the research, analysis and write-up of the Research Paper and should indicate approximate dates with key deliverables. *Dates of submission to both Advisors and the IMW must be those specified by the IMW.*

Friday 25 October 2019 Deadline for submission of RPP to Advisors

Friday 1 November 2019 Deadline for submission of RPP to RP Co-ordinators

Saturday 30 November Commence pilot test of quality assessment test

Friday 6 December Commence analysis of pilot test. Amend methodology and assessment if required.

Friday 20 December 2019 Complete Methodology and quality assessment test

Monday 13 January 2020 Complete literature review

January to March 2020 Collection of data at WSET

Wednesday 26 February 2020 Deadline for RPPs to have been approved by the RP Panel Chair (for final RP submission in June)

Monday 13 April Confirm submission of final Research Paper in June 2020

Monday 20 April Complete Statistical Analysis

Wednesday 13 May 2020 Submission of final Research Paper to Advisors

Thursday 25 June 2020 Submission of final Research Paper to the Institute, via Advisors, for examination